THE AEROPLANE and ASTRONAUTICS

APRIL 8, 1960

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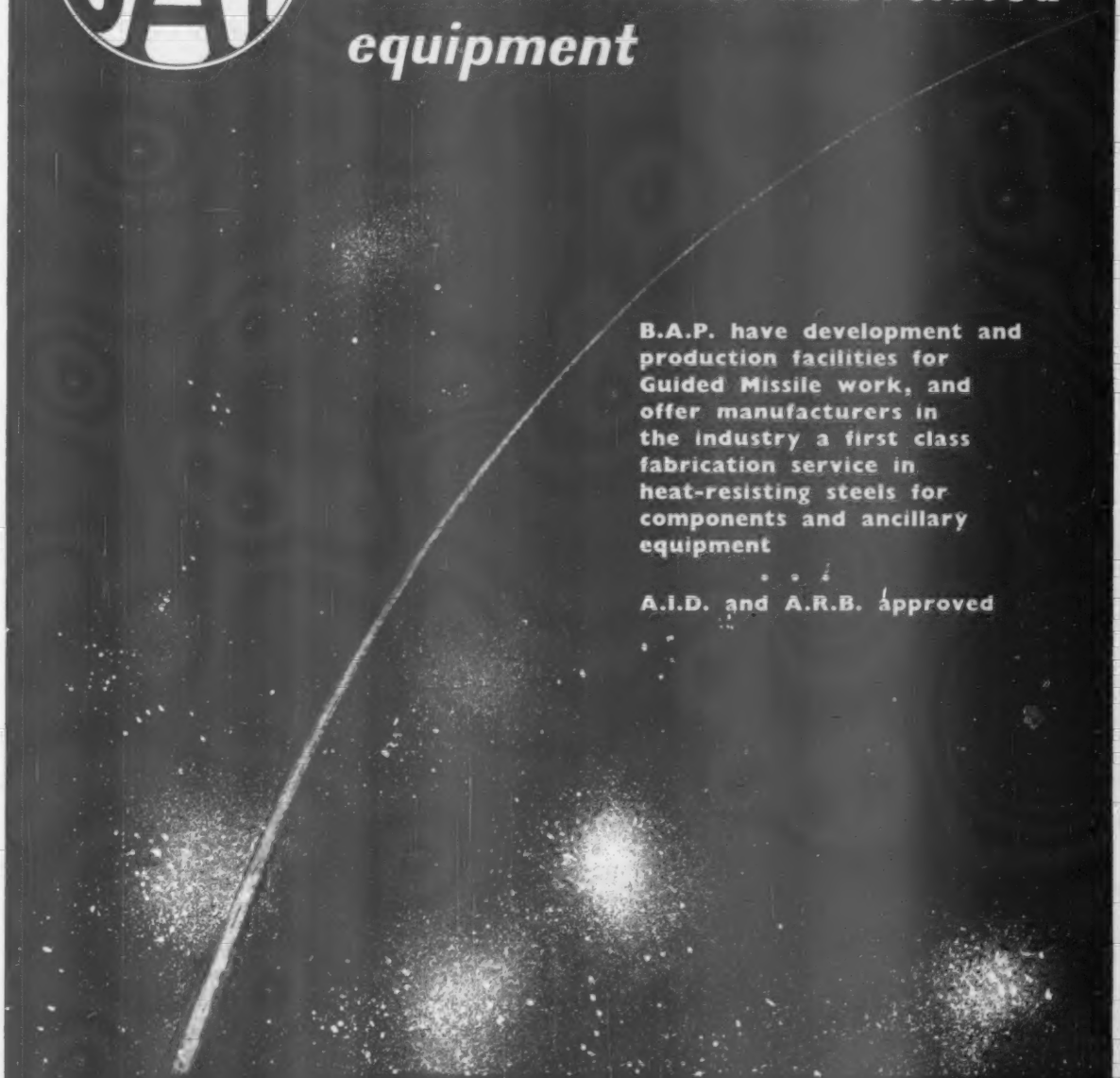

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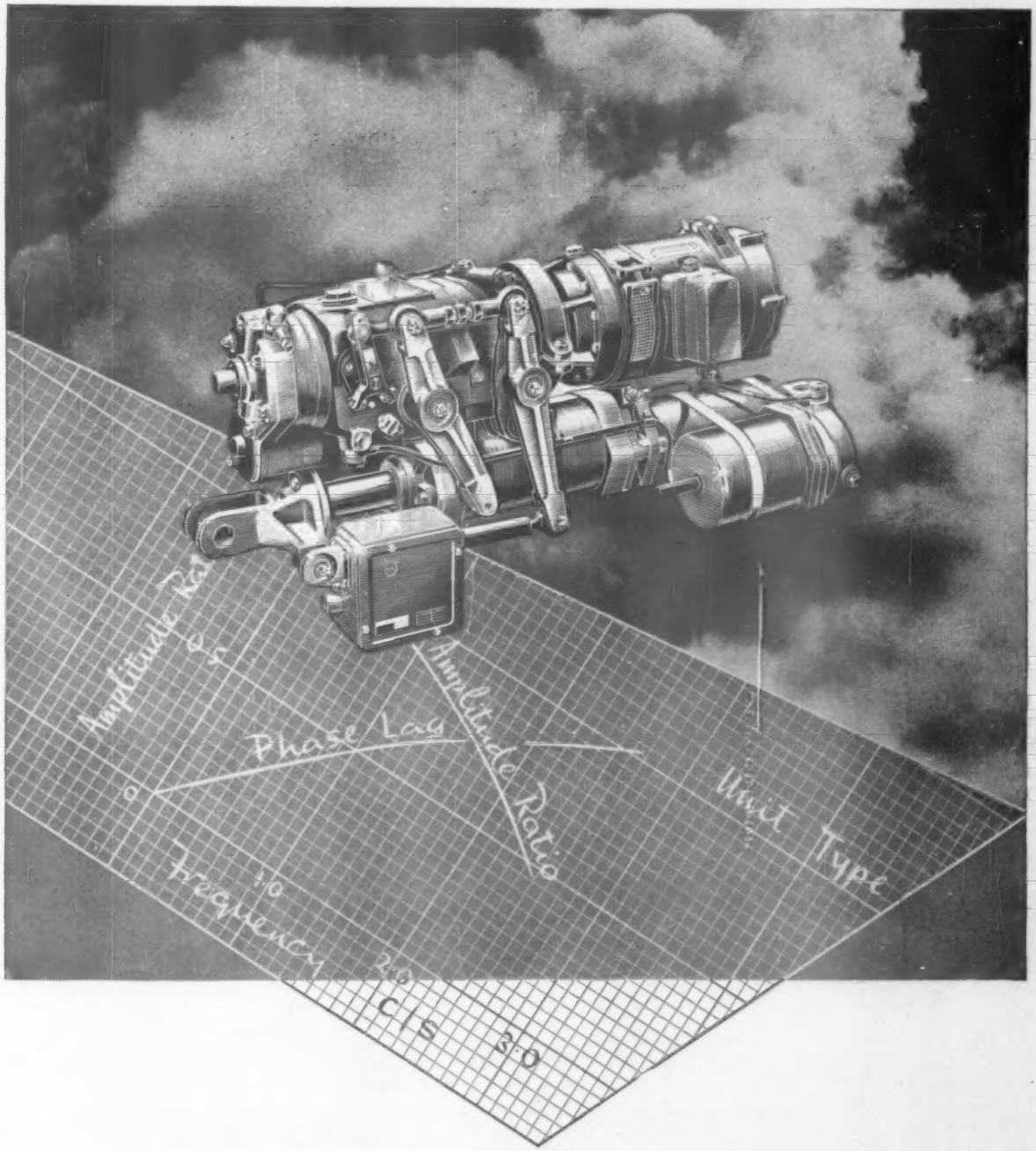

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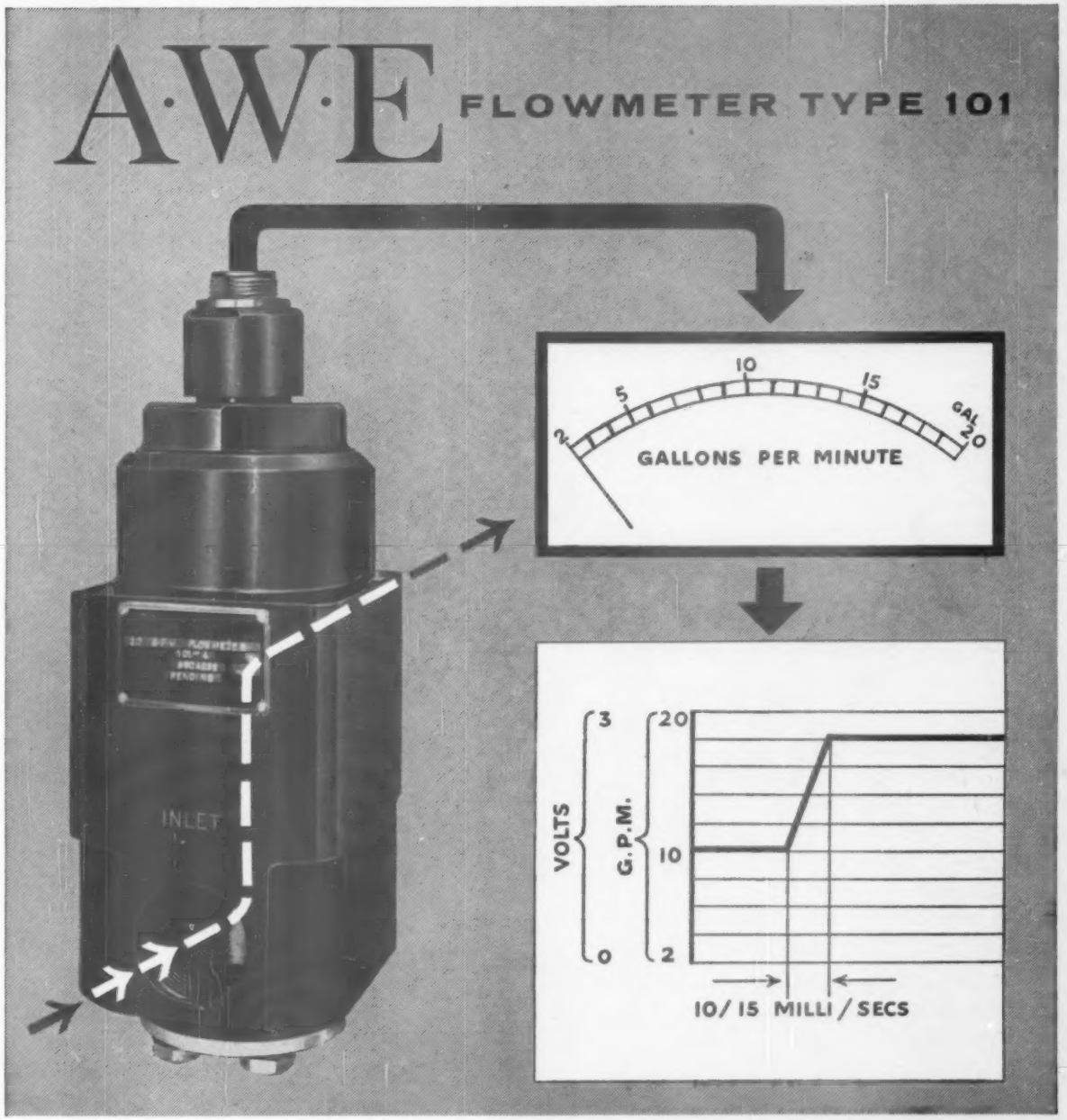

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THE AEROPLANE and ASTRONAUTICS

VOLUME 98 NUMBER 2529 APRIL 8, 1960

The Never-sleeping Watchdog

Nowhere will the successful launching of the U.S. television satellite be noted with more interest than in this country where, for some long time now, communication engineers have been pressing hard behind the scenes to get the authorities in this country interested in launching satellites for improving communications. This is a subject on which regular readers of this paper will be fairly well informed. It has been calculated that to put two suitable satellites into orbit would be cheaper than laying down a new suboceanic cable. And such launching can be done by using Blue Streak suitably staged.

Now, we suspect, the meteorologists will be getting interested too. How much more informative pictorial records of the weather taken by cameras carried in ever-circling satellites will be than reports from ground stations or weather ships, which, at the best, can only obtain records of the upper atmosphere by sounding rockets!

Also, the ever-circling and never-sleeping eye of the television satellite can obviously play a remarkable part in helping to keep the peace. Presumably, it will not be long before pictures taken in this way will be available for scrutiny at meetings of the United Nations.

Field of Promise

By the time these words are read, the Air League of the British Empire, through the medium of that forthright controversialist Sir Miles Thomas, will have presented its second report on the Future of British Air Transport. We have no idea what conclusions will be drawn in the Report, worthy though they will no doubt be. On the whole, British air transport is not doing so badly. What we should like to see, and perhaps this may be one of the items in the surprise packet which the Air League is to open on our publication day, Apr. 8, would be a forceful discourse on the potentialities awaiting the production in this country of aircraft for executive and personal transport use in the comparatively low-power, say below 600 h.p., bracket. This is the field which, as Sir Roy Fedden has pointed out, promises well for the small aircraft constructor and powerplant producer.

The type of aeroplanes we are considering in this context is that now being offered for sale in this country from the United States, from Italy and from France. No doubt it will only be a year or two before they are offered from Germany. In this country the whole field has gone by default and the one personality in British aviation who has been fighting vigorously to have a start made has recently announced his resignation from the big organization which at one time, it was hoped, was prepared to make a beginning in this promising market.

There is yet a third type of powered flight which exercises an appeal and that is the simplest form of flying, just for the fun of the thing with no specific journey in mind. Today the restrictions of Air Traffic Control and the initial cost of aircraft and engine have practically killed this form of sport.

But a promising possibility is in sight. The Government Establishment at Cardington has done much development work on inflated fabric structures. A brilliant development engineer recalls, in this issue, his successful work with an air-inflated 6 h.p. single-seater.

Has the time not come for private enterprise to take over and exploit this field?

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Matters of Moment

The Ever-circling Eye

AS anticipated last week, the Tiros I meteorological satellite was launched from Cape Canaveral on Apr. 1. Launching of the three-stage Thor-Able rocket went entirely to plan and the 270-lb. satellite was ejected into a nearly circular orbit with an apogee (greatest distance) of 468.28 miles and a perigee of 435.5 miles. It is pursuing an orbit which is inclined at about 48° to the Equator; its period is 99¼ min.

Details of the payload, which includes 9,000 solar cells and two small TV cameras, were given in THE AEROPLANE AND ASTRONAUTICS on Apr. 1. Still pictures can be transmitted direct to ground stations or as many as 32 can be tape-stored within the satellite for subsequent transmission, on command, when the vehicle comes within range of ground stations, one at Fort Monmouth, New Jersey, and the other at Kaena Point, Hawaii.

The tracking station at Woomera has been exchanging signals with the satellite to check the equipment. Once pictures have been transmitted, the tape is automatically wiped clean and can be used again. On the ground, the pictures are displayed on TV screens and recorded on film.

Soon after the successful launching, Dr. Harry Wexler, chief meteorologist of the U.S. Weather Bureau, reported that some "very fine pictures" had been secured of large stretches of the Earth's cloud cover. These would be immensely valuable in determining the value of a global network of weather survey satellites which should ultimately enable meteorologists to detect the onset of hurricanes and cyclones.

As Tiros (short for Television and Infra-Red Observation Satellite) is purely an experimental device, it is proposed to silence the radio transmitters after a period of 90 days.

Turbine Helicopters go to Sea

TWO Westland Wessex helicopters for the Royal Navy were formally handed over at Yeovil on Apr. 1. They were received by Lieut. Cdr. R. J. Turpin, commanding officer of H. Flight, No. 700 Squadron, an R.N. unit specially set up to handle the Wessex intensive service trials. These will mainly be flown from R.N.A.S. Culdrose. A large production batch of Wessex helicopters is on order for the Royal Navy. A preproduction batch has been engaged on intensive trials for some time.

Weighing 12,500 lb., the Wessex is the largest helicopter yet to be ordered by the Royal Navy. It is powered by a single Napier Gazelle turboshaft engine with a one-hour rating of 1,450 s.h.p. This turbine powerplant allows the Wessex to be airborne within 45 sec. of starting from cold.

Carrying advanced detection equipment and homing torpedoes, the Wessex is the first Royal Navy helicopter which can both find and destroy enemy submarines. The earlier, and smaller, Westland Whirlwind helicopters hunt in pairs—one carrying search gear and the other a torpedo. The Wessex will also eventually be fitted with equipment which will enable it to hover "hands off."

H.M.S. "Bulwark," the commando carrier equipped with Whirlwinds, may eventually also have Wessex helicopters and the commissioning of a second carrier to be equipped from the outset with the Wessex is being considered. The British Army has shown great interest in this new helicopter, which can carry 16 fully equipped troops or a 4,000-lb. payload.

The civil Wessex can carry 12 passengers over ranges in excess of 300 n.m. A later version, the Wessex 2, will be powered by two de Havilland Gnome turboshaft engines.

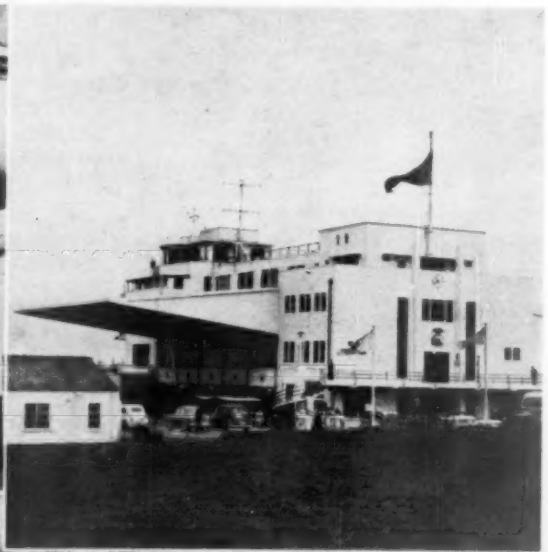
Congress at Stockholm

MORE details have been given of the arrangements for the 11th Congress of the International Astronautical Federation which is being held in Stockholm from Aug. 15-20. A very full programme is envisaged with contributions from leading scientists and engineers in many countries, including Russia, the United States and Great Britain.

This year the Congress is under the patronage of His Royal Highness Prince Bertil of Sweden and the programme is being organized by the Swedish Interplanetary Society.

Lectures are being arranged under 10 main headings: (1) *Basic sciences;* (2) *Planetary atmosphere environments.* This includes the basic structure of the atmosphere and the physical and chemical properties of atmospheric flight, including re-entry; (3) *Interplanetary Space,* including interplanetary matter, radiation, planetary magnetic fields, radiation belts, etc.; (4) *Space Medicine and Biology,* physiological and psychological aspects of life in space; (5) *Trajectories,* including powered and unpowered flight in space and within planetary atmospheres; (6) *Navigation, Guidance and Control, Space Communication; Propulsion,* present and future systems; (8) *Vehicles,* general system concepts, sub-systems, structures, materials, equipment, power supply, assembly in space, etc.; (9) *Space Probes, Satellites, High-altitude Rockets,* specific projects: descriptions and presentation of results, and (10) *Economic Factors,* economics and planning of space research, technology and development.

In addition to the main Congress sessions, it is proposed to hold four independent meetings. On Tuesday, Aug. 16, a Space Law Colloquium will be held; also the first parts of



BIRMINGHAM HANDOVER.—On Apr. 2 the airport at Elmdon was handed back to the City of Birmingham. Above, the Lord Mayor inaugurates the occasion by helicopter. Right, he receives documents from Mr. E. A. Armstrong of M.o.A. (extreme right), Councillor V. E. Turton, chairman airport committee (centre).

Photograph copyright "The Aeroplane and Astronautics"

FIRST FOR GREECE.—The first of the four Comet 4Bs on order for Olympic Airways came off the Hatfield production line last week. Olympic initially ordered three of these aircraft but recently increased this number to four.

a Space Medical symposium and a Small Sounding Rocket symposium. The latter meetings will be continued the next day. An Astrodynamics symposium has been arranged for Friday, Aug. 19.

Prospective authors are asked to communicate at once with the B.I.S., 12 Bessborough Gardens, London, S.W.1, but all inquiries concerning attendance and accommodation should be made direct to the Congress Secretary, IAF-60, Box 5045, Stockholm 5, Sweden.

L.A.P.'s Long-haul Building

THE traffic-flow system for the new long-haul passenger buildings in London Airport's Central Area will be similar to that of the present short-haul building—but there the resemblances end. When some details of the new buildings were given last Monday it became clear that the main philosophy behind the design was that of maximum flexibility in terms both of future expansion and detail modification.

The necessary flexibility is being obtained in three ways: the passenger terminal itself is physically apart from the associated office accommodation and can be separately expanded; the building is designed so that partitions can be readily rearranged; and the layout has been planned so that permanent piers ("fingers"), adjustable gangways, or "mobile lounges" can be adopted when experience elsewhere has shown which of these is likely to provide the best solution to the problem of passenger movements between terminal and aircraft.

The long-haul group consists of three buildings—the passenger terminal and two adjoining office blocks arranged around a vehicle-park forecourt. Passengers can enter or leave the terminal by covered ways on three sides of this forecourt. The buildings have not been planned for use by sightseers, but there is ample encouragement for passengers' friends. The design capacity assumes the arrival and departure of individual aircraft loads of 150 passengers or more, an increase of passenger movements to 2¼ million by 1970 and a maximum flow of about 1,000 passengers per hour.

Half of the passenger building should be ready for use by B.O.A.C. during the third quarter of 1961, with one of the two office blocks in use by the end of that year. Completion is planned for mid-1962.

Birmingham's Civic Enterprise

IN keeping with the view, firmly voiced by its Lord Mayor, that a city without an airport will diminish in authority, Birmingham is once again owner of Elmdon, seven miles out of town off the Coventry road. Twenty-one years after its inauguration by H.R.H. the Duchess of Kent on July 8, 1939, the airport has reverted to the corporation following some seven years of negotiation with the Government departments concerned with the requisitioning of the site for wartime purposes. These negotiations culminated on Apr. 2 when Mr. E. A. Armstrong, C.B., C.B.E., the retiring controller of civil aviation ground services at the Ministry of Aviation, handed over two documents to the Lord Mayor of Birmingham, Alderman John H. Lewis, O.B.E., J.P.

The proceedings were opened by COUNCILLOR V. E. TURTON, chairman of the City's Airport Committee, whose avowed object is to make the airport an industrious, prosperous, happy place. Last year some 190,000 people flew from Elmdon. This year the corporation are confident of raising the figure to 250,000.

MR. ARMSTRONG, trusting that the Government would have been found to have acted as a faithful steward, emphasized the principle of partnership which had been adopted. The Ministry of Aviation would continue to provide the technical services but the management would be provided by the City. He spoke warmly of the new Commandant, Mr. Jack Gordon. All the ground staff, wishful of doing so, he noted with approval, had been engaged by the corporation.

After a telegram from the Ministry of Aviation had been read, the LORD MAYOR made it clear in a vigorous brief speech that the City not only intends to enlarge the airport but also has its eyes firmly upon the potentialities of helicopter traffic and the need for landing sites near the town centre.

When the handing over ceremony had been completed an inaugural flight was made by a Westland Widgeon. It is worth pointing out that in our report of the opening in 1939 we recorded that the only truly civil operation on that day was the demonstration by Mr. R. A. C. Brie in a C40 Autogiro, but whereas on Apr. 2 the visiting aircraft of the R.A.F. (Beverley, Canberra, Venom, Jet Provost, Varsity) and of the Navy (Gannet and Whirlwind) remained on the ground; at the opening in 1939, in spite of the rain the Spitfires of the R.A.F. and the Skuas of the Fleet Air Arm put on quite a show. But then we were on the brink of war. Last week at Elmdon the most significant civil exhibit was the A.W.A. Argosy fresh from trials in the Sudan.

Noise in Parliament

AIRCRAFT noise—which led to that angry deputation waking Mr. Sandys up at seven in the morning and producing the hilarious picture of him in dressing gown and slippers on the front doorstep—is becoming—as Mr. Sandys warned some years ago—a terrible problem even though the Ministry is demanding steep rates of climb to minimize it as much as possible.

Mr. Sandys was asked in Parliament the other day when he was going to decide on the B.E.A. application to operate services at night with Comet 4Bs from London Airport. He replied that he has authorized B.E.A. to operate a small number of night services with the Comets subject to the condition that the noise level should not exceed that of piston-engined aircraft which are already allowed to fly at night without restrictions. Noise tests in the last few weeks had shown it was technically practicable (see p. 441).

But it was immediately pointed out to him by MR. ROYLE (Lab., Salford W.) that the statement would cause concern to people living under the glide path to London Airport. Mr. Royle wanted a pledge that if the precautions did not work, Mr. Sandys would reconsider his decision. Was he, Mr. Royle also wanted to know, thinking of extending this permission to other airlines?

Mr. Sandys gave a pledge to keep a close check on this himself. He has not so far received any other application.

"PARLIAMENTARIAN."

Airborne in the Victor

By John Fricker

TWO squadrons of Handley Page Victor B.1s are now operational within No. 3 Group, Bomber Command, at R.A.F. Cottesmore (Gp. Capt. A. D. Mitchell, D.F.C., A.F.C.), and these high-performance medium-bombers make an effective spearhead to the potent V-Force. No. 10 Squadron (Wg. Cdr. R. B. Phillips, D.F.C., A.F.C.) was the first to receive the Victor, when it re-formed in April, 1958, its crews having been trained at the O.C.U. (No. 232) at Gaydon. No. 15 Squadron (Wg. Cdr. J. G. Matthews, A.F.C.) followed on at Cottesmore in September of the same year, the station having been extended to take these large aircraft.

Some Victors are also in service with the Bomber Command P.R. squadrons at Wyton, and the type will take over the duties of some of the 3 Group Valiant bomber squadrons as these are transferred to the tanker role for flight refuelling. After the crew conversion at Gaydon, which comprises about six weeks' ground school and a similar period of flying totalling some 40-45 hours for the captains, plus intensive preparatory work in the Victor simulator, the squadron members have an exacting training programme to continue from their operational base.

The Bomber Command classification system of crews into combat, select and the rare "select star" categories is well known, and flying personnel have the opportunity of being regraded into a higher classification after successive training periods at six-monthly intervals. The success factor of the sorties which qualify for assessment is counted from the time the aircraft is airborne, and as subsequent equipment malfunctions are counted against the overall results, these also depend to a large extent on the performance of the ground crews.

The crew chief, in fact, is the sixth member of the V-bomber flight crew, and is taken on all sorties which entail landing away from base. These are likely to include "Lone Ranger" flights to Germany, Cyprus and farther afield, the "Western Rangers" comprising five-day transatlantic flights to the SAC base at Offutt, Omaha, via the American bombing ranges. As these names indicate, the "Ranger" flights are designed to breed self-reliance among V-bomber crews, who are required to qualify for servicing certificates for their mounts so that they can inspect, refuel, rearm and turn them around without outside assistance. In the case of the Victor, for example, all crew members must be able to repack the tail-braking parachute.

Having flown with the R.A.F. in the Valiant and Vulcan, I was particularly interested to visit Cottesmore, at Air Ministry invitation, to get a first-hand view of training in the third of the V-bombers. It was necessary first, however, to submit to a full aircrew examination again at the Central Medical Establishment, and then to undergo decompression training in the mobile chamber at Bassingbourn. This additional complication resulted from the lower degree of pressurization at present employed in the Victor compared with the other V-bombers, which offer cabin conditions as comfortable as those of the Comet.

Cabin altitude in the Victor is currently well above oxygen height, and the run in the "death chamber," as it is colloquially known at Bassingbourn, was therefore undertaken at the equivalent of 25,000 ft. for an hour to ensure no personal predisposition to the "bends," "chokes" or other cheerful symptoms of a low pressure environment. A rapid "descent," as air hissed into the chamber, exercised one's eardrums, sinuses, etc., with moderate violence and terminated an effective demonstration of the Air Ministry's interest in their guests' well-being.

It was also the occasion for a thorough fitting out with the A-13A-type oxygen mask, inner helmet and "bone dome" and familiarization with the pressure-demand system currently employed in high-flying R.A.F. aircraft. After the cabin altitude exceeds 10,000 ft., the oxygen feeds under slight pressure, and in the event of explosive decompression, a clamp on the mask can be instantly tightened to withstand the automatically increased flow of oxygen. One has to get used to breathing out slightly more forcibly than usual against the pressurized flow, and the tighter pressure of the mask at all times I found particularly uncomfortable: The A-13, however, may be one

VICTOR ASSEMBLY.—The author (bareheaded) with the crew of Victor XH 592 before flying from Cottesmore. L. to R. C/T Murray Ferguson (crew chief), Flt. Lt. D. Bryan (Capt.), Flg. Off. B. Anderson (A.E.O.), Flt. Lt. K. Handscomb (co-pilot). Navigators Flt. Lts. J. Churchill and J. Chaloner on steps.

of the ultimate developments of the oxygen mask, since the next stage, which will arrive with the Mk. 2 Vulcans and Victors, will be partial pressure suits or helmets.

At Cottesmore, I found that I was to fly with No. 15 Squadron, and at the Operations Block, which in the V-force has replaced the squadron crewroom system as a self-contained centre for briefing, intelligence and flying clothing and equipment, I met the crew on whom I had been inflicted. Its captain was Flt. Lt. Douglas Bryan, and the co-pilot, Keith Handscomb. The rear three crew members comprised Flt. Lt. John Chaloner (Nav./Plotter), Flt. Lt. Jim Churchill (Nav./Radar) and Flg. Off. Brian Anderson (Air Electronics Officer).

The navigators are particularly busy members of the V-bomber crews, both before and during flight, and in the Victor the co-pilot is responsible to a large extent for fuel control, weight and balance and associated calculations. The mission was to follow the normal five-hour training profile, with two simulated attacks against radar bomb-scoring sites in the Newcastle and East Anglian areas, followed by two long navigational legs up and down the length of the British Isles. After covering something like 2,500 miles, we were to finish up where we started, back at base.

Having kitted up in the comfortable and shower-equipped changing rooms of the Operations Block, we collected our flight rations and embarked on the small crew coach, which has oxygen supply points for pre-oxygenation, and air conditioning. Our Victor, XH 592, was ready and waiting on its dispersal pad, except for some last-minute attention under the supervision of Crew Chief C/T Murray Ferguson.

Crew arrangement in the Victor is more comfortable than in the other V-bombers, the flight deck being on a single level rather than stepped down at the rear. Accommodation is otherwise similar, with the pilots accommodated in two Martin-Baker Mk. 3L automatic ejection seats (cleared down to 90 knots at runway level), and the rear crew members in backward-facing sliding seats confronting their bench of electronic and navigational equipment.

Rails are provided for a sixth seat, for the crew chief, and this was installed, facing foward, for my benefit in XH 592. It could be slid forward as far as the well giving access to the prone bombing position which is for the V-bombers' rarely considered rôle of visual bombing. Sliding out between the pilots in the Victor is a large console of electric fuel controls with booster-pump buttons laid out diagrammatically for the mass of wing and fuselage tanks. These give the Victor a total fuel capacity greater than the 30-ton gross weight of a World War II bomber, and have a proportional feed system to maintain the C.G. within limits.

The Victor flight deck has extensive cockpit transparency which gives a rather better all-round view than in the other V-bombers, despite several robust hatch frames at eye level. The transparent hatches over the pilots have Martin-Baker explosive jacks for jettison, interlinked with the seat face-blind firing mechanism. It is not possible for the pilots to see any part of the airframe from the Victor cockpit, although the tiny rear cabin portholes give a view of the outer wings, and the periscopic sextant in the roof can scan the tail.

Instrument layout is surprisingly simple, with a full standard blind-flying panel on each side, and engine gauges in the centre, beneath the power-controls switches. The Hobson flight controls are fully power-operated with duplicated hydraulic systems. As a further safeguard, the ailerons and elevators are subdivided into two segments, with separate jacks, which will each afford sufficient control for a safe landing. Trimming of the adjustable tailplane is done by means of a high-rate switch on the control wheel, or a three-in-one actuator knob on the sidewall consoles.

These consoles are also the location of the small throttle levers for the four 11,000-lb. Sapphire 200 series turbojets, with inboard levers for the big rear-fuselage air brakes, which are infinitely variable in position and exert virtually no trim change. Forward of the port throttles are the undercarriage and flap controls, but on the Victor 1A these will be on the central panel. Other controls of interest include the nose-flap selector, for IN, AUTO, or OUT, and, in the mid-position, these leading-edge sections extend like slats on the approach to the stall. The Victor also has yaw dampers, Mach trimmers and the usual mod. con.

This general description of the cockpit must suffice because of security considerations, which also govern the mentionable detail of the flight itself. Some passenger observations, however, might, within those limitations, prove of interest in relation to the time schedule which was followed:—

12.15 hrs. Trussed up in flying suit and SARAH-weighted life-jacket, begin unbelievably complicated business of attaching to back-type parachute and seat-type dinghy in position on the sixth seat. Helped by navigator, manage to attach right straps to right connections and plug in to main oxygen supply. Bayonet-attached plastic tube from parachute "bale-out" bottle then joined on, and am warned not to detach main supply, in any emergency, before pulling the knob for alternative oxygen at the bottom of the back pack. This, because of automatic cut-off feature of main feed pipe, to draw attention to inadvertent disconnection.

12.25 hrs. Depressingly thorough briefing on emergency procedures begins. Am already resigned to virtual immobility and peculiar feeling of helplessness after being strapped in; most of briefing does not penetrate. Suddenly remember that this crew was the first to belly-land a Victor, after hydraulic failure, and that rear members baled out first on instructions from ground. Briefing begins to penetrate; must remember to pull parachute ripcord handle after diving out of side door if above 10,000 ft., to arm barometric opener. If below 10,000 must pull black knob below left shoulder to open 'chute. Other way round could be disastrous. Am then thrust smartly forward in seat and black-out curtains for rear cabin fastened behind me. Impossible to move head more than a few degrees any way.

12.30 hrs. Litany of pre-flight checks read out by rear crew member has rhythm and instantaneous response from pilots of Gregorian chant. Scots brogue of crew chief added through external intercom-point as he checks control surface, bomb door, flap and airbrake positions. Sudden burst of swing music through R/T as radio equipment checked. Now ready for engine starting with a few minutes in hand. This is point reached when preparing V-bombers for rapid scramble. External power then switched off, and aircraft kept at top readiness. Can then get airborne in four minutes at any time.

12.45 hrs. After selection, No. 3 engine starts on button being pressed, with accompanying sizzle of igniters through R/T, accelerates away after light-up at 10%, idles at about 40%. Other engines follow, with distant rumble, settling into subdued background hum. Sealed in our pressurized capsule, this will be our only accompaniment for next five hours. Slight wobble on a voltmeter checked as an aircraft idiosyncrasy.

12.50 hrs. Parking brake off, and taxi-ing out in easy sweeps with nosewheel steering. Hard ride over joints in concrete perimeter track at our nearly full fuel weight. Immediate pre-take-off checks—which result in bone-domes on and oxygen mask clamped uncomfortably into place—are continuation of non-stop flow since we entered aircraft. Remind one of enormous complexity of modern aeroplanes and pose question how they ever get airborne at all.

12.55 hrs. On to the tyre-scored threshold of concrete strip flanked by yellow sodium lights in typical overcast gloom. Count-down starts from half-minute before scheduled take-off at 12.59.4, with power checks at 70%. Then 5, 4, 3, 2, 1, and rolling on schedule. Slow acceleration at first, bumping on compressed oleos, then smoother ride as Victor stretches its wings to fly and boundary lights blur by. Effortless unstick at 140 knots or so, and warning flags in A.S.I.s clack in unison as undercarriage unlocks for retraction. More check items bring in flaps and clean-up aircraft.

13.03 hrs. Turning starboard to avoid Amber Airway, accelerate to 250 knots and burst through thin stratus that so often screens England from the Sun. Control turns us more starboard to avoid aircraft blip, and we see an Argosy slide across just below nose at 14,000 ft. In the blue desert of sky above cloud, streaked by decaying vapour trails, we find on this trip many travellers besides ourselves.

Still the checks continue; for oxygen above 10,000 ft., and at similar intervals. At 28,000 ft. cabin pressure equates to 10,000 ft. and one must exhale more forcibly against increased oxygen pressure. Airborne, the Victor snaps promptly into its turns as lightly as a fighter. This is no illusion: it will out-turn a Hunter at altitude. It is sensitive in pitch, and slightly difficult to trim in that plane.

13.17 hrs. Passing through 40,000 ft. Below solid blanket of stratus lies cold North Sea. Outside, minus 47 degrees Centigrade. Hot sunshine floods flight deck. Both pilots pull down green visors.

13.35 hrs. Turning on to first bombing run, calling up R.B.S. with details of simulated attack. Target is road crossing stream in hilly country somewhere below cloud blanket. Power reduced by ½% instalments to get speed right. Plotter begins calling range, and course corrections through radar bombing equipment relayed to pilot. Nothing resembles the war-time visual bombing technique; no "left, left, steady, right." Only surviving catch-phrase is "bomb away," in the significant singular, after a steady, unhurried run-in and a signal at the point of presumed release. Dr. Doppler and the radar boffins have produced the almost infallible means of getting an aircraft travelling more than 80% of the speed of sound at the precise point in inner space to achieve virtually a direct hit on an invisible target.

14.00 hrs. Tightly clamped oxygen mask suddenly becomes unbearable, biting on bridge of nose. Prompts reflection that technology still has some way to go. Cabin pressure equivalent to about 18,000 ft., but loosen mask to avoid loss of nose. Captain echoes sentiments by removing bone dome. Says: "like taking off a headache." Puts on Wimbledon-style eye-shield against glare. Who's for tennis? Navigator asks speed to be reduced by another five knots.

14.30 hrs. Turning over Blackpool for next R.B.S. run, which follows same procedure. Then start first nav. leg at 44,000 ft. up to point north of Isle of Lewis, W. Scotland, using primary nav. aids—beacon bearings, etc. At night, use astro. Turning back from overhead Ipswich, Vulcan flashes 2,000 ft. or less above stark white against deep blue. Close enough to see underwing serial: too fast to read it.

15.00 hrs. Lunch, or is it tea? Includes tin of soup (with heater handy on flight deck), sandwiches, banana, apple, chocolate, biscuits, chewing gum, boiled sweets. Watch pilots for technique of eating while on oxygen. Sequence: off mask, two or three bites, on mask for a chew before anoxia. Plastic tube for orange juice

no problem; pressurized coffee in thermos had sprayed mostly over co-pilot's lap on removing cork. Problem for I.A.M.

15.30 hrs. First sight of land. Just see snow-covered rocks in Scotland. Later turn back on 160° for second nav. leg. Co-pilot complains because will take us, according to navigator, nearly 45 minutes to fly entire length of the British Isles out to mid-Channel. All settle down to endure monotony—except navigators working busily in back.

17.05 hrs. Arrive just off Cherbourg, tip visible far below. Return to overhead base and start rapid let-down with full air-brake that slides one forward in seat.

17.35 hrs. Begin final ear-popping let-down from 32,000 ft. for ILS approach, GCA monitored, from 2,500 ft. Brings us inside late-afternoon stratus at 160 knots, with undercarriage and flaps down. Cockpit indicator of ILS on the blink, but navigator brings us in on centreline to meet glidepath for visual pick-up of cross-bar approach lighting at three miles. Smooth "roller" landing followed by another ILS circuit, for continuation training and a final "land and stream" call.

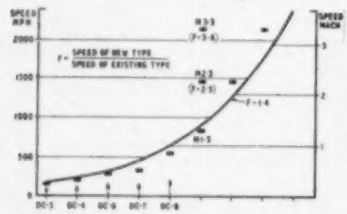
18.25 hrs. Co-pilot computes approach speed from landing weight, and captain calls for "slow cut" on round-out. Decisive touch-down at 122 knots, and powerful snatch of tail braking parachute concludes our sortie. Although I have been sitting virtually motionless for 5½ hours, I feel very tired.

Supersonic Caution

THE views of at least one airline engineer about supersonic transport projects were very clearly stated during this week's S.A.E. National Aeronautic Meeting in New York. Mr. B. S. Shenstone gave a number of cogent reasons why the airlines (which wanted to stay in business) were likely to be very suspicious of a technical and operational jump as immense as that from M=0.9 to M=3 plus.

He thought that an M=1.3 transport would be a natural and comparatively simple next development, and that an M=2.3 airliner would be permissible with present knowledge as a long-term project—and likely to be no less commercially practicable than any other supersonic target within the speed ranges so far considered.

Answering the question of why M=3 had been assumed to be the most sensible design objective, he suggested that



This curve—based on a 40% increase in speed for successive civil aircraft—gives a graphic demonstration of the technical leaps represented by M=2.3 and M=3.3 supersonic transports.

the most likely reason was that plans had to be laid to catch military orders. Certainly this figure was not chosen by or for the airlines and Mr. Shenstone considered that it would be possible, with no great technical ingenuity, to demonstrate a "best economics" figure anywhere between M=1.3 and M=3.5.

Successful airliners had, so far, increased in speed by 30-40%, as one type succeeded another; how were the airlines to be expected to swallow, at one gulp, a 350% increase? A 40% speed-increase was, starting with the DC-3, followed by the DC-4, DC-6, DC-7 and DC-8; aircraft cruising at M=1.3, M=2.3 and M=3.3 would follow the curve with fair accuracy. He did not think that the M=1.3 aircraft, which could be designed as an extrapolation of the classical aircraft, should be so contemptuously discarded; such an aircraft need not be uneconomic. Nevertheless, Mr. Shenstone was prepared to make quite a good case for M=2.0-2.3 as an upper limit for the next step in projected airliner development—though the problems were very considerable and the aerodynamic features of classical aircraft would need to be discarded.

The Coachmakers Dine

AVIATION and aeronautical interests were well represented among the liverymen and guests at the Livery Dinner of the Worshipful Company of Coachmakers and Coach Harness Makers, at the Mansion House on Mar. 22. The after-dinner speeches were opened by that distinguished member of the aircraft industry, SIR REGINALD VERDON SMITH, M.A., B.C.L., the Company's Senior Warden.

In a most lively speech, proposing the health of the Lord Mayor and the Corporation of London and the Sheriffs, he reminded the assembled company of the traditional association of coachmaking with the City of London. Through the years the craft of the coachmaker had, he said, played an important part in the Lord Mayors' progress. In the Worshipful Company they were not content to limit their interest to horse-drawn or horseless carriages. With customary adaptability they were preparing for the day when the Lord Mayor of our congested principal city would have to rely on vertical instead of horizontal take-off and to use the roof instead of the roadway.

In a reply full of apt quotations SIR EDMUND STOCKDALE, the Lord Mayor, paid a graceful tribute to the ladies and to Sir Reginald's speech; the latter toast, he said, during his year of office had never been more delightfully proposed.

Proposing the health of the Worshipful Company, HIS HONOUR JUDGE AARVOLD, the Common Serjeant, made a most entertaining speech. He spoke of the graciousness of days past and commented that just such an atmosphere was re-created by the functions of the Livery Company.

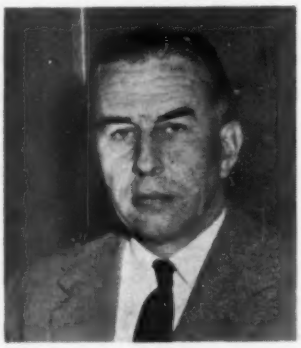
THE HON. DENIS BERRY, T.D., Master of the Company, in his reply also referred to the active interest taken by the Coachmakers in the motor and aircraft industries. These, he said, made a vital contribution to the well-being of the country both in terms of exports and prestige. He made special mention of the Company's "adopted" aircraft carrier H.M.S. "Centaur" which was due to return to home waters in April.

MAJ.-GEN. J. M. KIRKMAN, C.B., C.B.E., proposed the toast to the "galaxy of charming and distinguished guests." His Excellency THE LORD WAKEHURST, K.C.M.G., Governor of Northern Ireland, replied, and in a reference to aircraft and the way that the Coachmakers Company had taken changing methods of transport in its stride, commented that in aviation the term "coach" had not such a magnificent significance as it had had in the past.

A Vickers-Armstrongs Appointment

MR. G. F. H. HEMSLEY, F.R.Ae.S., has been appointed an additional member of the board of Vickers-Armstrongs (Aircraft), Ltd., with effect from Mar. 25, 1960. He will continue to hold his present appointment as chief engineer, aircraft.

Born in 1909, Mr. Hemsley was educated at Bedford School and City and Guilds Engineering College. He joined Vickers-Armstrongs in 1931 and, after spending some time in the wind-tunnel and aerodynamics departments, was appointed head of the flight test department in 1940. He held this appointment until 1950 when he became assistant chief aerodynamicist.



Mr. G. F. H. Hemsley chief engineer (aircraft) of Vickers-Armstrongs (Aircraft), Ltd., who is now an additional member of the board.

His extensive practical experience of flying was thus built up in a period which saw production or development testing of the Wellington, Warwick, Viking, Viscount and Valiant. Mr. Hemsley became chief aerodynamicist in 1951 and assistant chief designer in 1953. He was appointed deputy chief designer in 1955 and two years later became assistant chief engineer (aircraft). In January last year he became chief engineer (aircraft), and was appointed a special director of the company.

Retirement Well-earned

AFTER spending 45 years closely associated with the aeronautical activities of the Vickers-Armstrongs organization, Mr. Roy Edmonds, M.B.E., retired at the end of last month. He started his career at Vickers in 1915 when he went to the fitting shop at Weybridge after serving with the Armoured Car Division of the R.N.A.S., in Belgium. He subsequently became a chargehand and was promoted foreman of the fitting shop in 1918. After a spell in charge of the progress department he became works manager in 1940 and during the War carried the responsibility for the dispersed production departments.

In 1953, Mr. Edmonds was appointed works superintendent and 18 months later—when he was 65—became manager, works administration. He was appointed assistant to the general manager in 1957 and he held this post until his retirement.

Air Transport

Vanguard's West Indian Tour

FOR a relatively new aeroplane (it first flew less than fifteen months ago), the Vickers Vanguard has already made a large number of overseas appearances.

The pattern was set as long ago as May, 1959, when G-APEA, the first of B.E.A.'s Vanguard fleet and the second production aircraft, was demonstrated in Hamburg exactly fourteen days after its maiden flight. The same aircraft visited Brussels, Rome, Paris and Montreal in June, 1959, returning from Gander to Wisley direct in 5½ hours on Jly. 5. The decision to make the transatlantic crossing at such an early stage in the Vanguard's career was a fair indication of Vickers' belief in the basic reliability of the aircraft.

Between October and December last G-APEB spent just over 100 hours on tropical trials, completing 60 flights in eight weeks with an encouraging record of serviceability.

A more exacting test began on Feb. 26 this year when G-APED, the fourth B.E.A. Vanguard and the first fully furnished aircraft, began a series of route proving flights from London Airport.

These flights form part of the type certification programme and are operated on exactly the same lines as normal scheduled services, except for the absence of fare-paying passengers. Fifteen consecutive days of Vanguard route proving produced the following results: some relatively minor delays but 100% completion of schedules; 13 cities visited; and 43 sectors flown at an average daily utilization of 5 hr. 6 min. flying time (as opposed to block time).

At this point Vanguard G-APED returned from London Airport to Wisley in preparation for a short visit to the West Indies. The object of the visit was primarily to demonstrate the aircraft to British West Indian Airways, though the flying experience obtained would obviously be useful in the context of type certification.

B.W.I.A. is one of the earliest Viscount customers—as witness the type-number 702 for the airline's original fleet of Viscounts. This fact, coupled with the availability of a furnished Vanguard less than a day's flying away from Trinidad, prompted the decision to make the West Indian visit. Behind the decision, one should add, was the firm Vickers' belief that the Vanguard's economy and operational flexibility make it the ideal aeroplane for Caribbean regional service.

G-APED left Wisley for Piarco Airport, Trinidad, on Mar. 21, flying via Prestwick, Goose Bay, New York and Bermuda. At Idlewild, where the Vanguard was seen for the first time, a noise test flight was performed for the Port of New York Authority and a Press reception was held. The New York-Piarco leg was to have been flown direct but headwinds of up to 130 knots forced a refuelling stop at Bermuda; even so, the total flying time to Trinidad was only 16 hours.

Snow in New York delayed the Vanguard's arrival at Piarco on Mar. 22 by some 6 hr., but this was the only departure from a schedule agreed with B.W.I.A. a week previously. Local enthusiasm was such that radio interviewers and Pressmen waited at Piarco until 11.00 p.m. to meet the Vickers' team arriving aboard the Vanguard.

The aircraft was captained by Vickers' chief test pilot, Jock Bryce, with Capts. Dicky Rymer and A. S. Johnson (B.E.A.'s Vanguard Flight Manager) as co-pilots, together with Vickers' navigators D. L. Jones and D. J. Bowen and a B.E.A. cabin crew—Steward D. Wall and Stewardess Miss J. Walker. Passengers included an engineering sales team headed by Derek Lambert, assistant general manager (development).

In its cargo holds G-APED carried 10,000 lb. of spares and freight, including a Tyne engine and a complete set of undercarriage wheels. No spares were needed and the 10,000 lb. remained aboard on all demonstration flights, so the average "payload" exceeded 20,000 lb.

The Vanguard's ability to carry spare engines, which cuts the operator's out-station spares costs very significantly, always causes a stir at overseas airports. Similarly, the size and layout of the flight deck provide airline pilots with a pleasant shock. Perhaps these two features of the aeroplane best illustrate the value of demonstrations.

On Mar. 23 an operational, engineering and economics "presentation" of the Vanguard was given in B.W.I.A.'s town H.Q. in Port-of-Spain. A further presentation was made for the West Indies Federal Minister of Communications, the Hon. Andrew Rose, on Mar. 25.

The Vanguard's "official" demonstration flights were performed on Mar. 24. Nearly 200 B.W.I.A. officials, local dignitaries and Pressmen were carried from Piarco in three flights totalling nearly five hours' flying. The third flight was for the benefit of B.W.I.A. pilots and technicians, and included approaches to the stall, feathering and relighting. Reverse pitch was fully demonstrated on each landing and on one occasion Jock Bryce pulled the Vanguard up in an estimated 1,100 ft. to turn off the runway at the first intersection.

Undoubtedly the highlight of the Vanguard's West Indian visit, however, was the inter-island tour on Mar. 25, when B.W.I.A. pilots under Vickers' supervision took the aircraft on a 1,000-mile circuit in three hours' total block time, calling at Barbados and Antigua.

Carrying 10,000 lb. of freight and 60 people, the Vanguard flew the 216 miles from Piarco to Barbados in 45 minutes block time. A Pan Am DC-6B which left Piarco eight minutes ahead of G-APED was overtaken at Tobago, and it landed at Barbados 12 minutes behind the Vanguard. It was similarly outstripped on the 322-mile flight from Barbados to Antigua, which the Vanguard completed in a doors-shut-to-airsteps-down time of 60 minutes.

The take-off from Antigua was made from a 5,000-ft. runway in I.S.A.+17°C. This was felt to be a practical way of demonstrating Vickers' claims for the performance of the Vanguard under typical regional short-haul conditions. Not only is the aircraft capable of operating from Viscount airports, but it promises to be less demanding in terms of facilities, having its own twin passenger steps, internal starting and the ability to fly three sectors without intermediate refuelling.

The return flight from Antigua to Piarco (454 miles) was made in 1 hr. 15 min. Demonstrations successfully completed, G-APED left Piarco the following morning, Mar. 26, returning to Wisley via Nassau, Bermuda, Gander and Prestwick.

ISLAND MEETING.—Vickers' first and second generation turboprop airliners in company at Antigua. A 5,000 ft. runway in I.S.A.+17°C, plus substantial payload, gave the Vanguard an opportunity to demonstrate its short-haul capabilities here during its recent West Indian tour.

Air Transport . . . .

Stratoexpress to Prague

THE flying time between London and Prague was reduced to 100 minutes on Apr. 1 when Ceskoslovenske Aerolinie replaced its Il-14s with Tu-104A Stratoexpresses. B.E.A. Viscounts take 2 hr. 40 min. for the journey and the Il-14s previously took 4 hr. C.S.A. was the fifth World airline to introduce regular jet services, and has been flying three Tu-104As since December, 1957. A fourth (OK-NDD) has now been added and, resplendent in a new white and red colour scheme, was used for the inaugural London-Prague service, on which we were invited to fly.

This particular Tu-104A had been delivered only in February and still had the Aeroflot-type interior—the Russians had insisted, we were told, that C.S.A. accepted the aircraft as they were, although the 70-seat "A" model of the Tu-104 was designed to meet C.S.A. requirements before being adopted by Aeroflot. A more elegant interior is to be installed when OK-NDD, named "Plzen," undergoes its first 250-hr. check.

Upon its arrival at London Airport on Apr. 1, the Tu-104A demonstrated the use of the two large braking parachutes, following a rather fast landing. Carried in the extreme rear fuselage, they are a standard fitting on the Tu-104A (and, for that matter, on the Caravelle) but are not usually deployed.

Passenger impressions of the Tu-104A have already been recorded in these pages on several occasions. The flight to Prague with 64 passengers and 10 crew (including two captains and a radio officer under training) was made at 34,000 ft., at a cruising speed of 460 knots (Mach 0.80); C.S.A. quote cruising speeds for the Tu-104A from 432 to 513 knots. The time taken to climb to 34,000 ft. was 23 min., and the long, slow descent into Prague's Ruzyne airport was started some 30 min. before landing.

Two of the remaining three C.S.A. Tu-104As were to be seen at Prague on our arrival, together with one of the newly acquired Il-18s. C.S.A. performs all its own maintenance on these two types. The after-sales support given by Russia was described as excellent and the purchase price as "very favourable."

Originally, C.S.A. tried operating the Tu-104As on the services to Brussels, Amsterdam and Paris, but on these short ranges the cost was excessive, even for an airline which is State-supported. The current C.S.A. timetable shows that Tu-104As are scheduled to fly some 62 hours a week, which represents just over 800 hours per aircraft per year. In addition to the two London services each week, there are four to Moscow, one to Cairo and one through Cairo and Bahrein to Bombay. Passengers can fly from London to Bombay without changing aircraft in an elapsed time of 15 hours.

The first two of six Ilyushin Il-18s were delivered in January and after some weeks of proving flights are now operating, from Prague, four services a week to Zurich, three a week to Paris and one a week to Budapest, Beirut and Baghdad. When the remainder are delivered, they will take over completely from the Il-14s on international services. Six of the 25 Czech-built Il-14s will be converted to freighters, to supplement four Il-12 freighters now in use. C.S.A. serves 11 airports in Czechoslovakia and an air taxi service, with Morava L-200 or Aero 45 light twins, is available at another 70 towns.

Before the end of the year, C.S.A. hopes to open a service between Prague and Montreal, with one intermediate stop. As the Tu-104A has insufficient range for the North Atlantic (2,250 naut. miles with a 17,500 lb. payload), the Il-18 may be used initially, with the purchase of Tu-114s a distinct later possibility. There are plans, too, for services to South America and the Far East. For a country with only 13½ million inhabitants (as many as live in Greater London), C.S.A. has an ambitious programme, keyed to the need to show the flag abroad and win foreign currency for Czechoslovakia. The latest available statistics show that in 1959 C.S.A. carried 567,788 passengers and 11,934,000 kg. of freight.

K.L.M. Introduces the DC-8

FIRST demonstration flights of the Douglas DC-8 in Europe are now being made, following the delivery to K.L.M. of PH-DCA "Albert Plesman," flagship of the fleet. Our Dutch correspondent, who flew in this DC-8 between Amsterdam and Madrid on Mar. 29, reports that K.L.M. has adopted a 117-passenger interior with 24 first-class and 93 economy-class seats, respectively four- and six-abreast. Subdued tones of beige and blue have been chosen for the interior.

For the flight to Madrid, a distance of 1,000 miles, the DC-8 carried 65,000 lb. of fuel and took-off at 233,000 lb. (compared to the maximum permissible 310,000 lb.). With four 15,800 lb. Pratt & Whitney JT4A-3 turbojets, the DC-8 took a 32-second run for take-off and climbed away at 3,000 ft./min., reaching the 31,000-ft. cruising altitude in about 20 minutes.

K.L.M. have ordered 12 DC-8s, of which only the first three will have the JT4A-3 engines. The next four will have 16,800 lb. s.t. JT4A-9s, and the last five will have 17,000 lb. JT3D-1 turbofans.

Electra Investigations

THE effort now being put into the investigation of the causes of the Electra break-ups is reminiscent of that applied after the Comet disasters in 1954. Following the speed restriction (see last week's issue, p. 401) applied by the Federal Aviation Agency, a conference of representatives of the Civil Aeronautics Board, Electra operators and airframe and powerplant manufacturers was held at the F.A.A. headquarters in Washington on March 22. A tighter speed restriction of 225 knots at 15,000 ft. was imposed by the F.A.A. on March 26, with instructions for adherence to fuelling recommendations, the inspection of structure and the disuse of automatic pilots.

At the same time, a series of intensive flight and static test programmes is being conducted by the F.A.A., Northwest Airlines, Lockheed and the National Aeronautics and Space Administration. One of Northwest's Electras, with approximately the same hourage as that of the aircraft which crashed near Tell City, Indiana, has been flown to Lockheed for a structural analysis, and Northwest has taken back three Stratocruisers (traded in to Lockheed) to fill the schedule gaps caused by an accelerated inspection programme and by the temporary fleet shortage. According to *Aviation Week*, Lockheed is re-evaluating theoretical data, NASA is undertaking structural studies and the F.A.A. is directing the flight and static tests.

Although on-the-spot examinations of the wreckages have not yet produced final evidence, it seems that both aircraft disintegrated in the air and lost wings prior to this disintegration. Both wings of the Braniff aircraft failed, but the port wing was the first to fail, breaking at the inboard third of the No. 2 tank under high positive load. On the Northwest aircraft the starboard wing failed between the fuselage and No. 3 engine.

JETS ABOUNDING.—The tempo of jet transport operations in Europe is growing rapidly with the introduction of summer schedules and new equipment by many airlines. Illustrated here is the fourth C.S.A. Tu-104A at Prague after inaugurating the service from London, and the first K.L.M. DC-8 on demonstration at Madrid.

Only the VANGUARD

paces the jets at much less than half the cost

ALL ROUND Europe, and on record flights in Canada, the Vickers Vanguard has been logging block times which have proved that on short and middle distance routes it can more than hold its own with the jets. It has, in zero wind, beaten current jet schedules on sectors as long as London-Rome (955 st. miles). It has flown London-Gander (2,365 st. miles) in 5 hours 30 minutes, and Toronto-Montreal (335 st. miles) in a record 58 minutes in zero wind.

Other Vanguard block times are:

LONDON-BRUSSELS
230 miles in 45 minutes (5 m.p.h. headwind).

LONDON-HAMBURG
470 miles in 73 minutes—a record (17 m.p.h. tailwind).

LONDON-PARIS
224 miles in 41 minutes (zero wind).

PRESTWICK-KEFLAVIK
920 miles in 2 hours 35 minutes (zero wind).

KEFLAVIK-MONTREAL
2,360 miles in 6 hours 2 minutes (30 m.p.h. headwind).

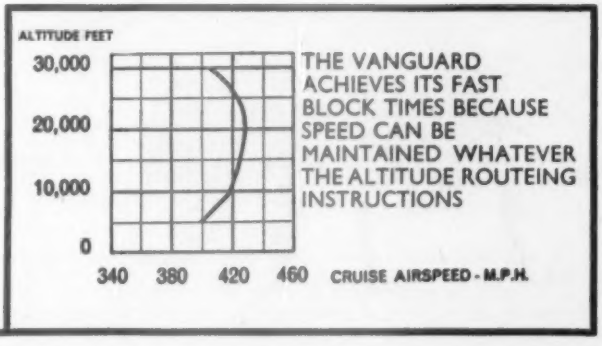
The Vanguard has achieved these block speeds at costs nearly one-third of those of comparable pure jet aircraft.

Recent U.S.A. figures show jet aircraft flight hour direct costs as 2.8 times greater than those of the Vanguard, and seat mile direct costs 2.6 times as great.

The Vickers Vanguard has, without doubt, the biggest profit potential ever offered to the airline industry — and it offers it at proved realistic competitive speeds.

The Economy Class cheap-fare capabilities of the Vanguard are at the forefront of the now established world movement for popular air travel. Only the Vickers Vanguard can bring these vast new markets to the Airlines on short and medium haul routes, at a substantial profit, and the Vanguard can do this with schedules as fast, if not faster, than any other aircraft.

Vanguard costs used in this comparison are to A.T.A. formula. Both the Viscount 745 and the Viscount 810 filed costs have been proved in practice to be substantially below such A.T.A. formula costs.



Of all the airliners only the Vanguard has all these features

425 m.p.h. cruising • Freight capacity 7/8 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience . . . ***And it is 'Viscount' quiet.***

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

• ***The airliner with the biggest profit potential ever offered to the operator***

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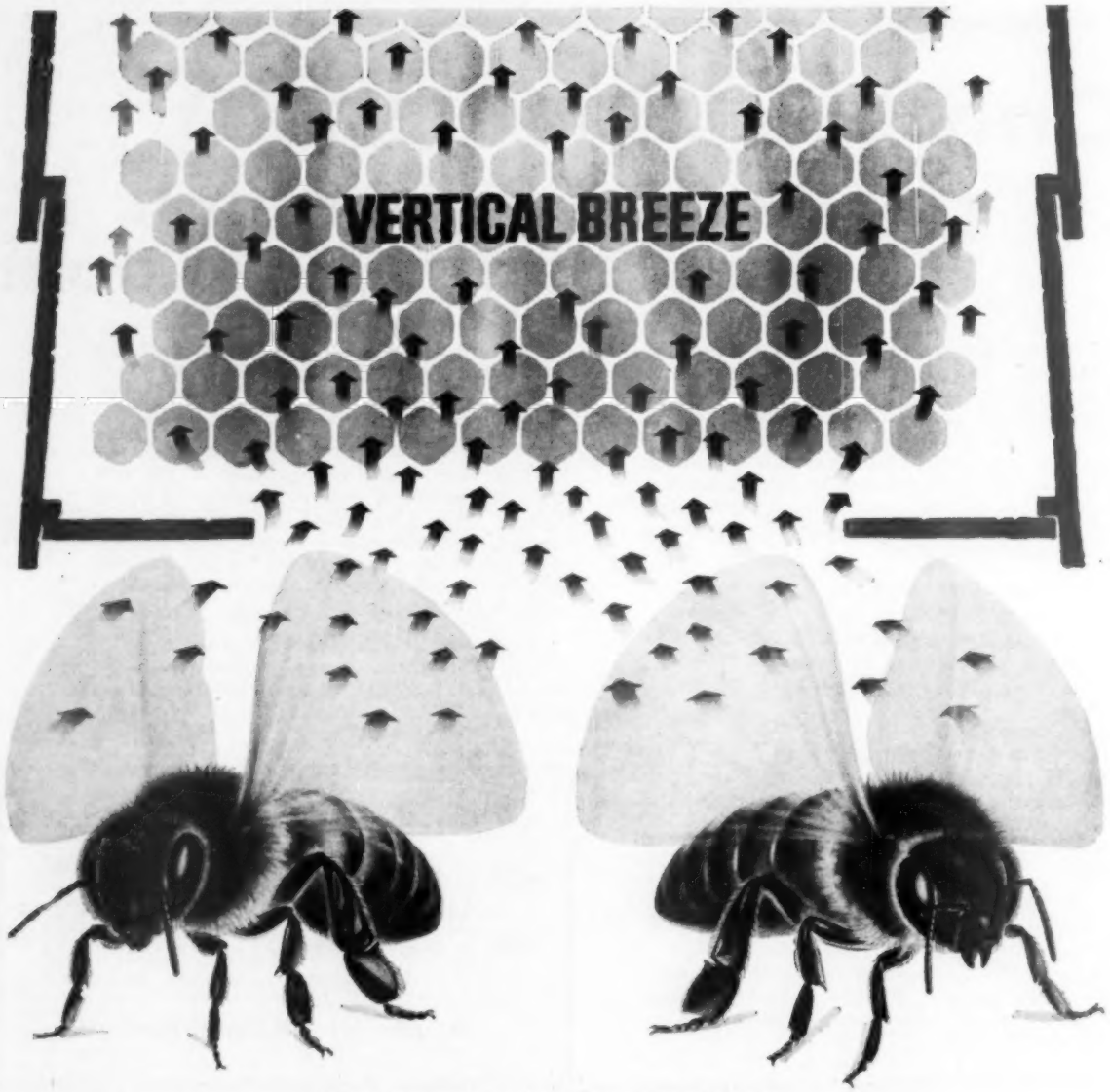

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The bees adjust matters by evaporation, fanning a forced draught up through the combs until in their judgment the product is right for its purpose. Hit-or-miss though the method seems, they achieve an extraordinary accuracy in meeting a self-imposed specification.

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Air Transport . . . .

New Bristol Links

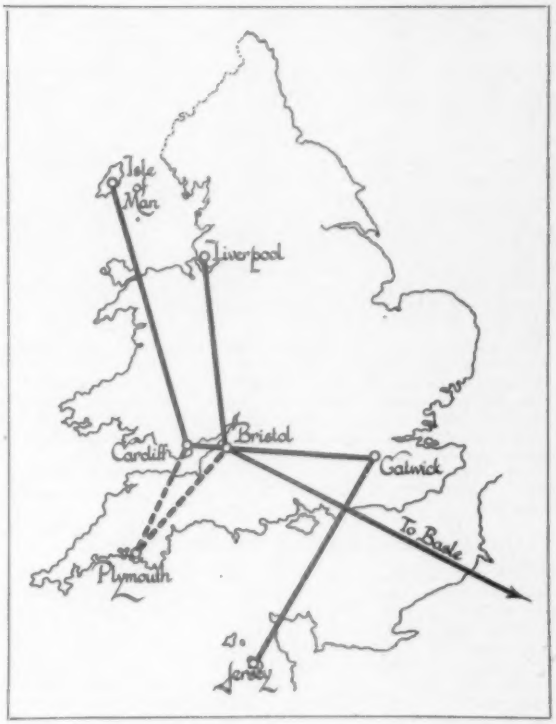
DAN-AIR SERVICES, as we noted briefly last week, introduced the first of its scheduled internal services based on Bristol on Apl. 4. Initially, three services a week are being flown by Dove between Bristol and Liverpool. The next stage of development will be the introduction of services to Cardiff and the Isle of Man on May 7, followed by a service between Bristol and Gatwick and from Cardiff and Bristol to Basle starting on Jly. 16. Also on Jly. 16 Dan-Air hopes to add Plymouth to its network, with flights from Bristol and Cardiff, subject to Government approval being obtained.

Dakotas will be used for the service to Basle and Doves for the other internal services, at least initially. Later, if traffic grows as expected, Dakotas or Ambassadors can be introduced. Dan-Air has a fleet of 14 aircraft of five different types, having purchased three Ambassadors and two Doves since the end of last summer. The remainder of the fleet comprises two Dakotas, three Bristol 170s and four Yorks, and all their aircraft have been purchased outright.

With this diverse fleet, Dan-Air offers facilities for a wide variety of charters. The Yorks are used only as freighters, and, in addition to flying the nightly round-trip between Glasgow and London by way of Manchester, on charter to B.E.A., they are kept well used on long-distance flights to the Far East and Australia for the M.o.S. A weekly freight service to Rome and Milan has now been started, and one to Brussels will begin in June, also for B.E.A. Utilization is about 2,000 hr. a year for these four aircraft.

The Bristol 170s achieve only half this utilization on general charter flying for freighting or carrying up to 44 passengers. The Dakotas are equipped to carry 32 passengers in easily removed seats and achieve about 1,500 hr. on charters, inclusive tours and scheduled services. The Doves are eight-seaters and the Elizabethans, purchased complete with a stock of spares from Butler Air Transport, are 49-seaters, retaining the original B.E.A. layout. It is too early yet to say what utilization will be achieved with these two types, but both are available for charter and the Elizabethans have already been booked for a useful number of tours this season; in addition, they will be used on the Gatwick-Jersey scheduled service on Saturdays between Jne. 18 and Sept. 10, in place of the Dakotas used last year.

Dan-Air chose to base its new network of internal routes on Bristol in the belief that a useful traffic potential exists in the area. Most of the schedules are based on the concept of allowing the Bristol businessman a full working day at his destination. Good facilities exist at Lulsgate Airport, which was officially opened as Bristol's municipal airport in 1957,



although the longest of the three runways, at 4,232 ft., is too short for the Ambassador at full weight. An extension to 5,250 ft. is planned to be completed by the end of this year, with possible future extension to 6,000 ft.

Other users of Bristol at present are Cambrian Airways, North-South Airlines and Aer Lingus, with a service to Dublin.

Founded in March, 1953, Dan-Air Services is a wholly owned subsidiary of Davies and Newman, Ltd., a leading and long-established London company of ship brokers. At present based at Blackbushe, it is about to move to Gatwick, with one Dove permanently based on Bristol. All maintenance of the Dan-Air fleet is done by another Davies and Newman subsidiary, Dan-Air Servicing, at Lasham.

MATS Versus the Rest

U.S. TRUNK airlines are reported to be alarmed at the support being given in Congress to a plan to re-equip MATS over the next five years with a fleet of over 300 modern turbojet transports. The airlines have been expecting to obtain a substantially greater share of the MATS traffic than the 50 million ton-miles at present subcontracted.

The contention that much of the passenger and freight traffic carried by MATS could and should be carried by the airlines has had the support of Senator Mike Monroney, powerful aviation spokesman in the Senate. The failure of the major airlines, including American, Eastern, Pan American and Flying Tiger, to support the Monroney Bill, which would have provided a Government guarantee for loans of up to $85 million for the purchase of new cargo aircraft, has now, however, led the Senator to view sympathetically the MATS re-equipment plans.

These were recently outlined by the MATS commander, General William B. Tunner, before the House Armed Services Sub-committee and the Senate Appropriations Sub-committee on the Armed Services. The plan is in two stages, involving the purchase of interim equipment while a turbofan or turbojet "workhorse" is developed for deliveries in five years' time.

The interim stage of the plan envisages a fleet of 50 large cargo carriers such as the Douglas C-133 (of which MATS at present has 30), together with 45 specially modified Boeing KC-135s to provide high-speed mobility for supplies delivery, and about 50 cargo versions of the Boeing 707, DC-8 or Convair 600. The MATS KC-135 would have Pratt & Whitney TF-33 turbofan engines for operation from 6,000-7,000 ft. runways, and would carry between 60,000 and 70,000 lb. of cargo. Boeing would start deliveries in mid-1961.

As the interim cargo-carrier, Boeing has versions of its 735 available, based on the commercial 707, with swing-tail, rear, or side loading, to carry up to 100,000 lb. Douglas has similar variants of the DC-8 with swing tail and turbofan engines and has been reported to be building a prototype privately. A Convair 105 has also been reported, in *Aviation Week*, as a MATS freighter of about the same size as the Convair 600.

For its ultimate "workhorse," of which 242 would be needed, according to Gen. Tunner, MATS wants a 440-knot cruising speed and the ability to carry 40,000 lb. for 400 naut. miles, or 20,000 lb. for 5,500 naut. miles. No doubt Boeing, Douglas and Convair will all submit proposals to meet this specification when it has been written in detail. Lockheed is already reported to have proposed its GL207-42 as a swept-wing, turbofan-engined variant of the Super Hercules project. The fuselage would be similar to that of the C-130B Hercules, but 24 ft. longer, and the cost would be $4.9 million each.

The Air-freight Business

IN these notes for the March 18 issue (pp. 333-334) an attempt was made to demonstrate with figures the minuteness of the ratio of the U.K. air-freighting to surface-freighting traffic. A similar comparison for the U.S.A. was made last month in an address by a Canadair executive. He said that of the 1,400,000 million freight ton-miles recorded for 1958, only 420 million was airborne. This is equivalent to 3/100th of one per cent.

But the smaller the proportion, the greater the prospects of expansion. Assuming an overall U.S. freight ton-mileage increase to about 2,500,000 million by 1975 and an improvement of the air transport ratio to as little as one per cent, then the air-cargo share will be about 25,000 million ton-miles. This traffic would involve the full-time use of 500 freighters of Canadair CL-44 capacity and prospective productivity.

Aeroplane fuselages—except those specifically designed for freighting—are of a shape to provide even the most experienced

Air Transport . . . .

loading teams with a successive series of headaches. Among the few really major cargo items which fit the shape are ships' propeller shafts—but, with normal loading doors, these have to be taken round some near-impossible corners. Such items have been in the air-freighting news recently. On March 24 a 22½-ft.-long, 8½-ton shaft was wangled into an L-1049H at Manchester Airport for transport to New York, and the day before, at London Airport, a similar shaft weighing about 13½ short tons (12,447 kg., to be exact), was loaded into a Lufthansa L-1049H for Malta. Each was claimed to be the heaviest single item of cargo to be loaded at the respective airport.

Surveying the A.T.C. Problem

WHEN it began to become obvious, several years ago, that air traffic control and navigational methods were due for some extensive reorganization and development, there arose the need for a simple, but thorough and objective, statement of the problems and possible solutions. This was primarily required not as information for individuals directly concerned with these problems and solutions, but for the re-education of those who are indirectly involved.

Following the work done by various groups during the past two or three years in the U.S.A., the U.K. and Holland, the complexity of the problem and likely practical solutions are now understood well enough for a complete and useful statement to be made. Such a statement—a book* based on a series of studies and reports on future requirements for dealing with the problem—has recently been produced as a "Marconi Review" publication.

This might be described as a primer which has been designed for the non-specialists who are aware of the general requirements and difficulties, but who are not necessarily in day-to-day contact with the newest radio, radar, A.T.C. and computing techniques. It covers the development of the present A.T.C. systems, describes communications and navigation methods, "raw" and synthetic radar, data-processing and other ground-based equipment, and then explains how the available aids might be used to solve some of the problems. No attempt is made to make a case for any particular solution; the problems are stated, present and future equipment are discussed and solutions are then outlined. A most useful book for those who wish to be brought up-to-date and to understand present-day thinking on this vitally important but extremely complex subject.—H.A.T.

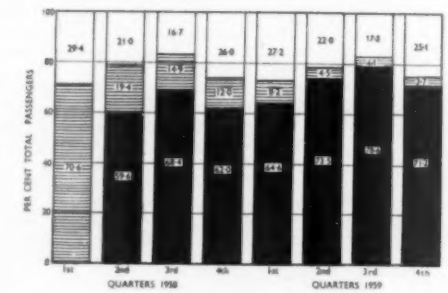
* "Air Traffic Control" by C. D. Colchester. Published by Marconi's Wireless Telegraph Co., Ltd., Chelmsford, Essex. 17s. 6d.

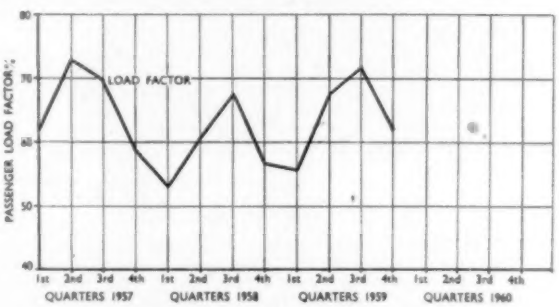
North Atlantic Traffic Results

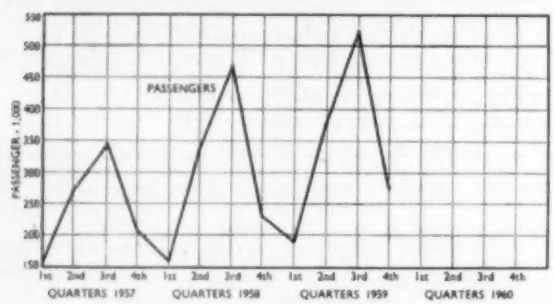
IATA statistics show that North Atlantic traffic in 1959 established the customary new records. After the slight falter in the upward trend in 1958, the total of passengers carried surged forward again with almost a 20% increase, and the average passenger load factor was restored to a healthy 66% after dropping to its post-war low of 61.1% in 1958. As we noted briefly last week, freight carried across the North Atlantic increased by 45.4%. More than half the total of 32,800 tonnes of freight was carried as "fill-up" on passenger flights, but the number of scheduled all-cargo flights increased by 20% and the amount of freight carried on these flights increased by 73%.

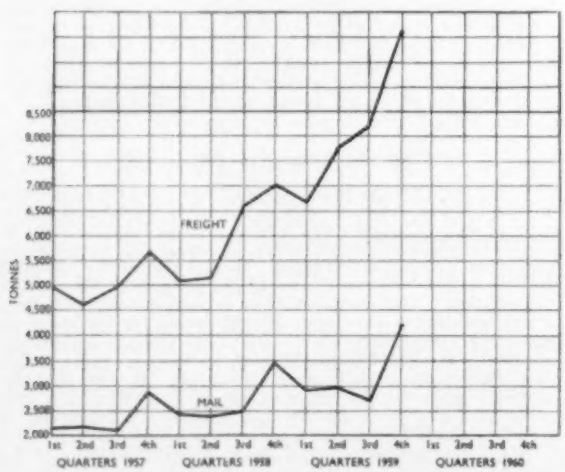
For the first time since 1950, the number of passenger flights operated decreased (by 3.1%), but the use of larger aircraft meant that 6% more seats were offered.

In addition to the scheduled operation, tabulated here, there were 2,442 charter flights on which 172,647 passengers, 3,589,876 kg. of freight and 2,674 kg. of mail were carried.









FOURTH QUARTER, 1959

	Eastbound	Westbound	Total	% change over 1958
Scheduled flights	3,454	3,363	6,817	+ 3.4
Seats offered	222,198	222,338	444,536	+10.0
Revenue passengers :				
First	31,914	37,432	69,346	—
Tourist	4,168	5,941	10,109	—
Economy	80,746	115,608	196,354	—
Total	116,828	158,981	275,809	+20.3
Pass. load factor, %	53.0	70.4	62.0	+ 5.3
Freight, kg.	4,212,934	6,004,764	10,217,698	+45.9
Mail, kg.	2,216,519	1,803,877	1,803,877	+15.3

YEAR TOTALS, 1959

	Eastbound	Westbound	Total	% change, 1958
Scheduled flights :				
Passenger	14,043	14,101	28,144	— 3.1
Cargo	1,303	1,220	2,523	+20.6
Seats offered	1,032,170	1,038,871	2,071,041	+ 6.0
Revenue passengers :				
First	147,281	146,879	294,160	+15.0
Tourist	29,895	34,467	64,362	−76.6
Economy	473,353	535,412	1,008,765	+52.2
Total	650,529	716,758	1,367,287	+14.6
Pass. load factor, %	63.1	69.1	66.0	8.0
Freight, kg.	15,319,595	17,469,953	32,789,548	45.4
Mail, kg.	7,004,967	5,491,065	12,496,032	15.4

The Fighting Services

R.O.C. Nuclear Exercise

A LARGE proportion of the resources of the Royal Observer Corps is being mobilized this week-end to monitor, measure and report on radio-active fall-out during a Civil Defence exercise organized by the Home Office. A one-day test—"Signal Fire"—it is planned within NATO and the United Kingdom monitoring service will be connected with Denmark, Holland, Belgium and France.

Some 700 heavily protected underground posts have been built in this country in the past three years. In these R.O.C. personnel can operate, fully self-contained and supported, for long periods. Of these posts, about 200 will be manned during the exercise when a total of some 1,500 R.O.C. posts will be operating.

Expedition Training

A SCHEME aimed at widening the scope of recreation and outdoor activity in the R.A.F. is to start in the near future. Organized by a committee under the chairmanship of the Assistant Chief of the Air Staff (Training), it will provide support for expeditions by officers and airmen considered to be of value in the development of character, initiative and leadership.

Expedition training will initially be encouraged chiefly among cadets, apprentices and boy entrants, the object of the scheme being to induce the less expert members of the Service to take part in such ventures.

Low-level Turbulence Trials

PRELIMINARY conclusions drawn from the results of the 12-month "Swifter" high-speed low-level flight trials over Libya, which are planned to finish in July, show that it is possible for aircraft to stand up to the effects of turbulence and buffeting of continuous low-level operation.

The six Canberra B.2s which are being used in the trials are operating from R.A.F. El Adem under the command of Sqn. Ldr. P. A. Thomson of R.A.E. Farnborough. Except for the C.O., all the aircrew are drawn from the five M.E.A.F. Canberra squadrons in Cyprus. They do a two-month spell on the trials and during their detachment the two-man crews complete between 80 and 90 hours. A day's maximum flying is two sorties with a minimum of four hours between each.

Special equipment and modifications in the bombers include a different cabin air and ventilated suit system, which is going to incorporate new refrigerator units; counting accelerometers; and fatigue meters. To keep the crews cool on the ground before a sortie, the aircrew coach has been fitted with a refrigerator unit and compressed-air cylinders are used for suit cooling in the Canberras prior to engine starting.

Except for one test, all of the sorties are flown with individual aircraft at an altitude of 200 ft. and a speed of 300 knots. There are three different routes: one is a figure-of-eight course from El Adem to Benghazi and Derna with legs over the sea, and high and low terrain; the second is to the south over flat desert away from coastal effects; and the third is made over the sea and flat cultivated ground.

In addition, one three-aircraft test is completed each week. At intervals of a few minutes, one Canberra flies at 200 ft. over the land and 100 ft. over the sea, the next at 400 ft. and 200 ft., and the last at 600 ft. and 400 ft. respectively. This provides a means of comparing conditions at varying heights at a particular time.

Apart from these daylight tests, low-level night sorties are flown by Sqn. Ldr. Thomson during full-moon periods. These are made over the desert at an altitude of 500 ft.

On the completion of each sortie the crews answer a questionnaire. This includes such items as the temperatures at various points on the route; estimated turbulence; ambient weather temperature; cabin temperature on entering the aircraft, during engine-starting and take-off. Other points cover individual comfort and feelings during and after the flight.

EL ADEM TRIALS.—Canberra B.2s belonging to the "Swifter" detachment (Sqn. Ldr. P. A. Thomson) at R.A.F. El Adem, Libya.

Photograph copyright "The Aeroplane and Astronautics"

GLASWEGIAN GUEST-NIGHT.—A.Plt. Off. G. R. Goudie, the Senior Student, Air Marshal Sir Hugh Constantine, Air Chief Marshal Sir Theodore McEvoy, Wg. Cdr. D. M. Finn, the Principal and Vice-Chancellor, Sir Hector Hetherington, and Air Vice-Marshal J. F. Hobler.

At Glasgow University

AT the annual dinner of the Glasgow University Air Squadron on Mar. 24 the A.O.C.-in-C. Flying Training Command, Air Marshal Sir Hugh Constantine, presented the Aerobatic Trophy to A.Plt. Off. D. A. Cameron and the Weir Trophy for the best all-round first-year cadet to Cadet Pilot John Bethell.

WG. CDR. D. M. FINN, the Officer Commanding, welcomed the guests, who included the Principal and Vice-Chancellor, Sir Hector Hetherington, the Air Secretary, Air Chief Marshal Sir Theodore McEvoy, the Commander-in-Chief, Flying Training Command, Air Marshal Sir Hugh Constantine, the Air Officer Commanding, No. 25 Group, Air Vice-Marshal J. F. Hobler, and Dr. S. C. Curran, Principal of the Royal College of Science and Technology. Sir Hector, he said, had become a "jet jockey" at the incredibly young age of 71 years, when he flew in a Vampire Trainer at the Squadron's summer camp last year.

SIR HECTOR HETHERINGTON, replying, said that he was happy that over the years an intimate relationship had been built up between the University and the Royal Air Force. He was most keen that this interest should continue to be fostered, and he was glad to see so many senior officers of the Royal Air Force at the dinner.

AIR CHIEF MARSHAL SIR THEODORE MCEVOY said that even should the Royal Air Force obtain no recruits from the University Air Squadrons, nevertheless these squadrons would still be doing a very necessary job in creating a sympathetic interest in the Royal Air Force amongst that section of the community which must inevitably go on to positions of responsibility. There was, moreover, a very great need for graduates in the Royal Air Force.

There was a future for manned aircraft, and pilots would be needed for as far ahead as could be seen. Passengers preferred to have humans monitoring their passage from A to B, as opposed to a guidance system in what might virtually be a missile. There would be a greater requirement for Coastal Command in the future, and even in Fighter Command there was still a requirement for

The Fighting Services . . . .

manned fighters for purposes of investigation and use in overseas theatres where their flexibility could be used more advantageously than the missile. He reminded everyone that once dispatched the missile could not be recalled, whereas the manned aircraft could. Amidst laughter, he said that a suspect aircraft might after all only be Sir Hector in his Vampire.

A. PLT. OFF. GOUDIE, a medical student, replying to Sir Theodore, said how pleased members were to belong to the Squadron, and put in a plea for a more powerful aircraft for University Air Squadrons, and hoped that Provosts would soon be provided.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Gp. Capt. A. G. Abel to the Department of the Air Member for Supply and Organization; Gp. Capt. G. C. Godfrey, M.B.E., and Wg. Cdr. J. D. de S. McElwain to the Department of the Chief of the Air Staff.

Fighter Command: Gp. Capt. R. K. Cassels, C.B.E., D.F.C., A.F.C., to Headquarters as Command Work Study Officer; Wg. Cdr. T. P. Gibson, D.F.C., to R.A.F. Uxbridge, Middx, as Regional Operations Officer.

Coastal Command: Wg. Cdr. I. B. Clark, M.B.E., to Headquarters for signals staff duties.

Flying Training Command: Gp. Capt. H. H. Eccles, M.A., to the R.A.F. Flying College, Manby, to command; Gp. Capt. J. D. T. Revell, C.B.E., to Headquarters for special duties.

Technical Training Command: Wg. Cdr. J. W. Sim, G.M., M.A., to the R.A.F. School of Education, Uxbridge, Middx, to command.

Maintenance Command: Wg. Cdr. A. S. Duff, O.B.E., to No. 14 Maintenance Unit, Carlisle, as Chief Equipment Officer; Wg. Cdr. G. L. Mattey, D.F.C., A.F.C., to No. 19 Maintenance Unit, R.A.F., St. Athan, to command.

Middle East Air Force: Wg. Cdr. A. R. Boardman to No. 103 Maintenance Unit, R.A.F., Akrotiri, Cyprus, to command.

Other Appointments: Gp. Capt. D. B. Hatfield, C.B.E., to the Ministry of Aviation; Wg. Cdr. W. J. F. Fenton to Allied Air Forces Central Europe for plans and policy duties; Wg. Cdr. E. W. Merriman, O.B.E., D.F.M., to the United States for Transport Operations duties with No. 839 Air Division, Tactical Air Force; Sqn. Ldr. W. J. O. Morrison, A.F.C., to Allied Air Forces Northern Europe for tactical operations duties with acting rank of Wg. Cdr.

More Service News

Bomber Command Reunion.—The 15th annual reunion of the Headquarters Bomber Command Association of Officers will be held at R.A.F. High Wycombe on Saturday, May 21. Any members who have not received details can obtain them from the honorary secretary at Headquarters Bomber Command, R.A.F. High Wycombe, Bucks.

Squadron History.—A history of No. 120 Squadron is being written by Flg. Off. I. S. McNair, who would be glad to hear from any readers who can assist him. All correspondence should be addressed to Flg. Off. McNair at R.A.F. Kinloss, near Forres, Morayshire.

No. 60 Squadron Reunion.—The seventh annual reunion of the No. 60 Squadron Officers Dinner Club will be held at the R.A.F. Club, London, on April 29. Tickets, price 13s. 6d. each, can be obtained from Air Cdre. W. Wynter-Morgan, Wentworth, Mount Hermon Road, Woking, Surrey.

New R.A.A.F. Neptunes.—Twelve Lockheed P2V-7 Neptunes are to be purchased by the Australian Government to replace the G.A.P. Lincolns operated by No. 10 (MR) Squadron. The R.A.A.F. already has two squadrons equipped with P2V-5 Neptunes which have been modified to P2V-7 standard by the installation of the two J.34 turbojets in wing-mounted pods.

Flying College Dinner.—This year's annual dinner of the R.A.F. Flying College Association is to be held at R.A.F. Manby on June 9. Further details will be circulated to members in due course.

A Great Fighting Force

ON July 14, 1936, Air Marshal Sir Hugh Dowding arrived at an almost empty house near Stanmore to begin the work of building up Fighter Command. The name of the house, Bentley Priory, then known to few, has since become famous all over the World. For it was from there that the first really effective air defence force was organized and directed.

Before the formation of Fighter Command, all the fighter squadrons at home—and they were not many—had been grouped in the Fighting Area, which was a part of the cumbrous formation known as the Air Defence of Great Britain. But the rapidly growing power of the German Air Force had seriously alarmed the Government, and it was decided to split up the Air Defence of Great Britain into two functional commands. Thus did Fighter and Bomber Commands come into existence.

The story of the building up of Fighter Command into a great fighting force, and the record of its achievements has been well told by Air Vice-Marshal P. G. Wykeham, himself a distinguished fighter pilot, in his book, "Fighter Command."*

When the first Commander-in-Chief, Sir Hugh Dowding, began his task he found that most of what we now call the infra-structure was lacking. As Air Vice-Marshal Wykeham says:—

> "He had to weld together slowly increasing quantities of aerodromes, squadrons, radar, guns, aircraft, balloons, communications and headquarters, and most important of all, men and later women, and make them into a single fighting machine, responsive to a central control, sensitive yet tough and durable, flexible and fluid as only an air weapon can be. He had to reach into the future, knowing that whatever he planned would take months and even years to come to fruit. He knew from experience that he would never get what he asked for, but only what he could win by argument. A long road stretched ahead of him, but before he had covered it Fighter Command was to be an organisation unique in the World. No other country had such a defence mechanism, and at its zenith it was to be a marvel of what human ingenuity could devise."

The new Commander-in-Chief's task was, however, made easier by the fact that in 1935 the Air Ministry realized that we had begun our rearmament far too late to enable us to build a bomber force capable of taking the offensive and carrying the air war into the skies over Germany. It was therefore decided—and, indeed, there was no alternative—to give full priority in research, development and production to air defence.

Our hopes of creating a successful air defence organization rested on two very important developments—the eight-gun fighter, for which specifications had been issued in 1933, and the new device for giving early warning and aiding interception, then called R.D.F. and later known as radar. Air Vice-Marshal Wykeham gives a fascinating account of how this was done, and how the Battle of Britain—surely one of the few decisive battles of history—was won against great odds.

After the defeat of their daylight attacks the German Air Force turned to night bombing, and Fighter Command had to deal with the difficult problems of interception in the dark. New radar devices had to be developed and new methods worked out, in circumstances of great urgency. But before these problems were fully solved, the night raids died away as the Germans turned their attention to the exigencies of their campaign against Russia.

The Command's next task was to play its part in the preparation for "Overlord," the Allied invasion of Europe, and to support our armies after they had established themselves in France. As the majority of our fighters had to move overseas with the armies, the Command lost a great part of its strength to the 2nd Tactical Air Force. Worse still, it lost its name and assumed the revived title of the Air Defence of Great Britain.

Under this name it fought its last and in some ways its most difficult battle, against the V-1 flying bombs. These new weapons presented the Command with some of its most intractable technical problems. They were solved by a carefully thought-out combination of fighter interception and radar-controlled A.A. guns. By the end of August, 1944, 74% of the flying bombs that reached our coasts were being destroyed, and by the end of the campaign the figure had risen to no less than 83%.

After the end of the War Fighter Command, which had regained its name, was greatly strengthened by re-equipment with jet fighters, but the development of nuclear weapons seriously complicated the problems of air defence. The invention of thermo-nuclear bombs made a general defence of the country impossible, and Fighter Command's present task is to prevent the destruction of our nuclear deterrent.

The future of the Command in this age of missiles and nuclear weapons is somewhat uncertain, but it is quite clear that we shall still need manned fighters to intercept and identify suspected hostile aircraft. And the air-to-air guided or homing missile will maintain the power of the fighter to destroy any form of aircraft, even in the supersonic age. In addition, we shall need fighters, for as long as can be foreseen, for use in limited wars.

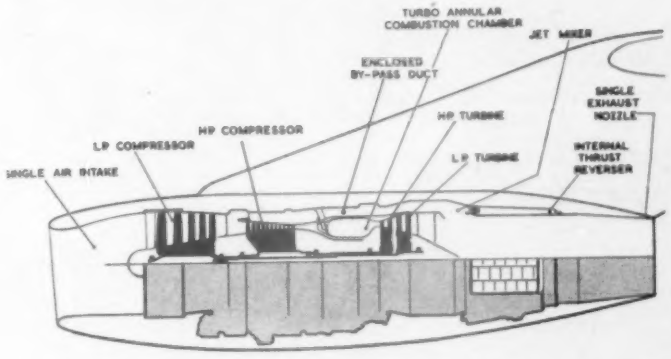
Air Vice-Marshal Wykeham writes with a knowledge of his subject that few can equal, and with a literary skill not always to be found in works of this nature. The book is strongly recommended to all students of military history, and to everyone who would like to know how we avoided disaster during that terrible year when, after the collapse of our Continental allies, we stood alone.—ROBERT SAUNDBY.

* "Fighter Command," by P. G. Wykeham. Putnam. 30s.

Rolls-Royce Views on the By-pass Engine

TODAY, Mr. A. A. Lombard, Rolls-Royce director of engineering, and Mr. D. Gerdan, the Allison director of engineering, are lecturing on "Turbofan and By-pass Type Engines for Jet Transports" to the Society of Automotive Engineers in New York. Although this is nominally a joint paper, it appears to have been written completely by Rolls-Royce; the joint authorship will be taken to confirm reports of Allison and Rolls-Royce collaboration in this field.

The lecture gives an excellent survey of the latest Rolls-Royce thinking about the by-pass engine—and their reasons for considering it superior to other types of turbofan engine. Emphasis is put on the major effect of noise requirements on engine design. In addition, the internal layout of the RB.141 is revealed. The following account is based on the lecture.



INSIDE THE RB.141.—This drawing reveals the internal layout of the Rolls-Royce RB.141 by-pass engine. It has five L.P. and eleven H.P. compressor stages; each compressor is driven by a two-stage turbine. Unlike U.S. turbofans, it has continuous pod lines and no separate fan efflux.

Three basic parameters which decide the suitability of an engine for a given aircraft duty are: its installed fuel consumption; installed powerplant weight and bulk; and installed cost. Other considerations, including the experience of the manufacturer in commercial gas-turbine operations, may be an important factor in the actual cost of maintaining the engine in service. The word "installed" is important, since it can be misleading to compare engines merely on information contained in the manufacturer's brochure.

This is shown in Fig. 1 where specific fuel consumption for a typical subsonic cruising condition is plotted against by-pass ratio—incidentally, for a higher pressure ratio and turbine inlet temperature than is current U.S. practice. The diagram shows how the performance of the basic engine compares with its actual performance after allowance has been made for air bleed and power off-take, pod drag and thrust reverser and silencer losses. The final curve shows a minimum cruise s.f.c. at a by-pass ratio around 1.4.

This is not the complete picture—the effect of engine weight must be included and it must be the installed weight, not just the basic weight. On this criterion the best engine is a pure jet, taking the size of engine required to satisfy the most severe aircraft requirement (which may be take-off, climb or cruise depending on the type of engine).

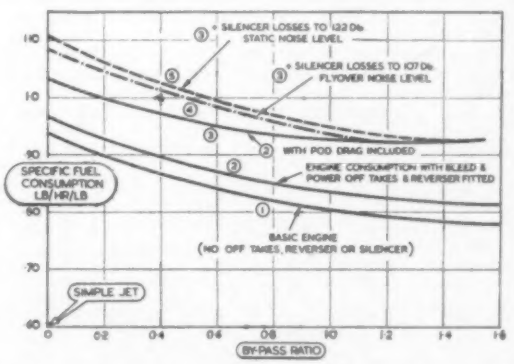

* SILENCER LOSSES TO 122 Db STATIC NOISE LEVEL
* SILENCER LOSSES TO 107 Db FLYOVER NOISE LEVEL
WITH POD DRAG INCLUDED
ENGINE CONSUMPTION WITH BLEED & POWER OFF TAKES & REVERSER FITTED
BASIC ENGINE (NO OFF TAKES, REVERSER OR SILENCER)
SIMPLE JET
SPECIFIC FUEL CONSUMPTION LB/HR/LB
BY-PASS RATIO

Fig. 1. Relationship between s.f.c. and by-pass ratio, with allowances for losses.

These criteria of s.f.c. and weight are conflicting. The engine will have a by-pass ratio between zero (pure jet) and 1.4, depending on the relative importance of s.f.c. and installed weight, and thus upon the aircraft mission.

If engine-plus-fuel weight is plotted against by-pass ratio for an aircraft designed for a 1,000-n.m. stage with typical reserves, Fig. 2 is obtained. The picture is greatly affected by the specified noise requirements—the best by-pass ratio lies between 0.65 (if no silencer is required) and 0.8 if the engine is silenced to extremely low noise levels.

At greater stage lengths a higher by-pass ratio shows up better—but not to any large extent. This is partly because the long-range aircraft flies higher and, therefore, puts more emphasis on a lighter engine and less emphasis on fuel consumption. For a 4,000-n.m. stage length the variation with by-pass ratio is small and the gains to be obtained by going beyond a by-pass ratio of 1 are negligible.

The third important parameter is engine price, which can be influenced greatly by engineering philosophy; for example, by concessions to ease production which may adversely affect engine performance. Other things being equal, for a given thrust the higher the by-pass ratio the higher the weight and therefore the cost.

In Fig. 3 an attempt has been made to include the effect of engine price. It shows a plot of direct operating costs for a 1,000-n.m. stage against by-pass ratio and indicates an optimum between 0.7 and 1.05 depending on the noise requirements. British European Airways specify for the D.H. 121 a noise level of 100 PNdb. at a point on the ground 2¼ miles from the start of the take-off run. This is 6db. quieter than both the Comet 4 and Viscount.

(Continued on page 434)

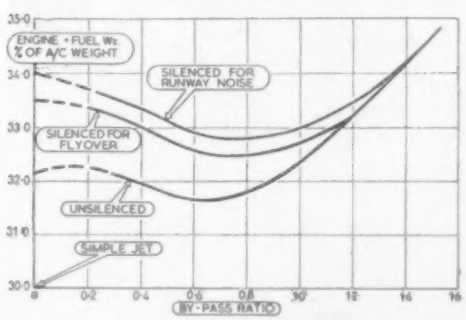


Fig. 2. Variation of engine-plus-fuel weight with by-pass ratio for a 1,000-n.m. stage length.

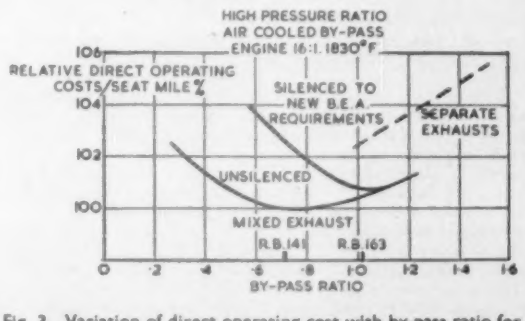


Fig. 3. Variation of direct operating cost with by-pass ratio for a 1,000-n.m. stage length, based on constant specific engine price with aircraft optimized for each engine case.

Inflated Fabric Aircraft

by

D. Perkins*

WHEN I was asked to write an article on air-inflated aircraft, with particular reference to a small 6 h.p. delta wing, I was somewhat dismayed at the task of recalling details of an aircraft designed and made in 1955. Being a poor record-keeper and an inveterate "off the cuff" designer, it has involved me in the study of lots of small grubby pieces of paper, some incomplete and often inaccurate drawings, and a great deal of memory searching.

Photographs of a developed two-seat air-inflated aircraft appeared in the Press some time ago. (See THE AEROPLANE, May 31, 1957.) The prototype, designed, made and flown at Cardington, had a delta wing of 500 sq. ft. area, mounted on a tricycle frame. A two-seat in-line cockpit was built within six vertical members supporting the wing, and attached to the two rear members was a 70 h.p. target-aircraft engine, driving a pusher propeller. Controls consisted of half-span elevons, with a single rudder mounted on the upper surface of the wing. They were operated by a normal stick and rudder bar through flexible steel wire. The gross weight was about 900 lb. As with almost every aircraft ever built, it was felt that a much more efficient machine could be designed, once the prototype had flown.

Cardington had, as most people know, always devoted its efforts primarily to the problems of making inflatable equipment and by this time I had become an even more ardent believer in the future of air-inflated aircraft and was given permission to continue development on a small scale.

It had been my belief, from the early stages, that the ultimate aim should be an aircraft that was completely inflatable, except for the engine and wheel struts. With this object in mind, and assisted mainly by Mr. Alan Lock, work was started in 1955.

The first obstacle to be overcome was the lack of a suitable power unit, but since the only engine available below 70 h.p. was a 6 h.p. twin-cylinder two-stroke, it was "Hobson's Choice."

We had, some time previously, built an inflated full-size orthodox model of an Auster, using the 6 h.p. engine with a direct drive to a 3-ft. propeller. Since the engine ran at 4,000 r.p.m., the propeller was very inefficient, we only managed to extract 1 h.p. from it and the machine proved capable of only short hops. Also, the cockpit and tail unit were still of rigid construction, although the fuselage was all inflated. The machine was not capable of being deflated and rolled up, and the engine, designed to run flat-out only, had given some trouble.

However, by gearing down the engine, through two Vee-belt pulleys and a lot of jiggery-pokery to the carburetter, including the incorporation of one large drawing-pin for a float needle, we managed to get 1¼ h.p. from the propeller! The unit, when complete, resembled an outboard motor, incorporating petrol tanks, dry batteries for ignition, and hooks on the end of the two control wires, and weighed 40 lb. complete.

It was designed to clip on to the rear end of the fuselage and was supported by the two spark-plug bodies and one peg. The control wires from the pilot could then be hooked on, and the longest job was doing up the six propeller bolts. The propeller was of laminated spruce and weighed 4 lb. For those interested in the facts of life, one 4-ft. propeller equals a lot of bad language, two sacks of shavings and considerable loss of blood!

While these engine troubles were being sorted out, construction of the wing was going ahead.

We had returned to the delta plan form, for its strength and simplicity of manufacture, but changed almost every detail of its construction.

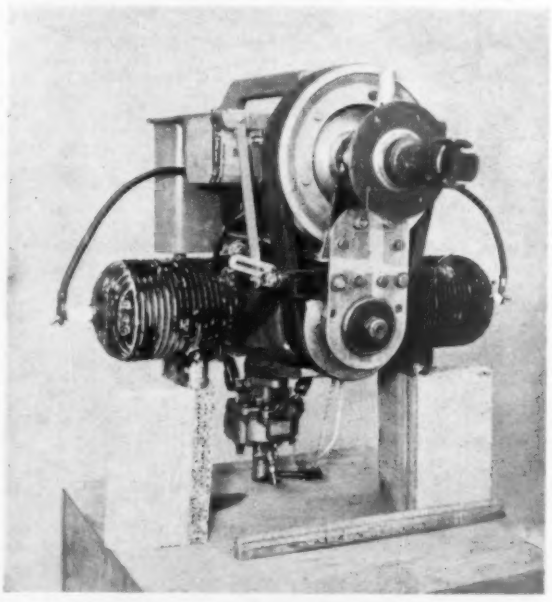
The first major change, was to reduce the wing area to 160 sq. ft. since we did not, at that time, believe we could carry two men on 1¼ h.p. Some of our well meaning but rather depressing visitors often expressed the view that we would be lucky to lift one!

To make sure that the original prototype machine was stable and easy to fly, the wing had been swept back 90° and washed out 10° at the tips. Combined with a low C.G. this had reduced the efficiency of the wing at top speed, since it required large elevon angles to make small changes in pitch.

Its efficiency was further reduced by its thickness/chord ratio of 25%. This deep section was chosen, to give maximum rigidity, but when built it was found to require down bracing to the fuselage.

It was clear that, if we were going to improve the aerodynamic characteristics of the machine, some means of stiffening the wing must be found.

A study of a pneumatic beam in bending, through a series of



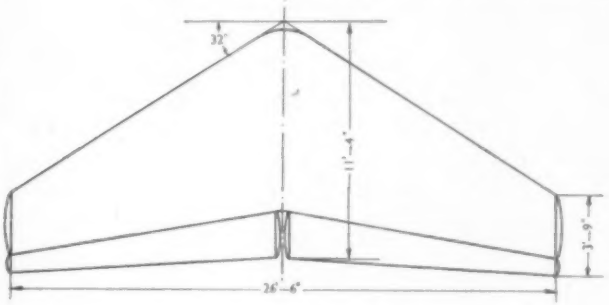
The power unit, a 6 h.p. twin-cylinder two-stroke weighs 40 lb. (dry) complete with fuel tank and ignition batteries and mounting. The laminated spruce propeller weighs 4 lb.

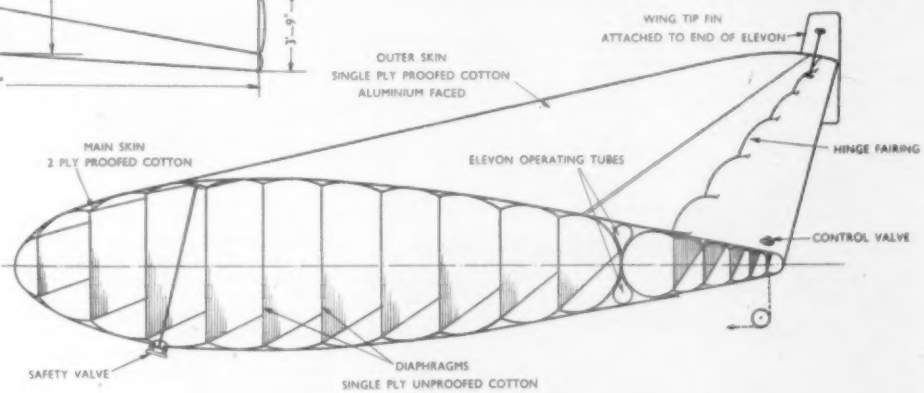
* Deputy Head of the Research and Development Establishment, Cardington, which is part of the Mechanical Engineering Department of the R.A.E.

tests, showed that its resistance to deflection was a measure of the load extension curve of the textiles used to make it.

We were then able to build a beam in which we had incorporated special materials in the surfaces and succeeded in reducing the deflection to 10% of the original. Using this new information, we reduced the sweepback to 64° with a thickness/chord ratio of 20% and aspect ratio increased from 3 to 3.5. The wing section was R.A.F.69. To make the machine more manœuvrable, the washout was reduced to 8° at the tips.

Built as a pure cantilever, we estimated that the wing would sustain 4g up and down loads at 1 lb./sq. in. pressure; tests on the completed wing confirmed this.





SECTION THRO' WING

A plan view (above) of the wing and (right) a diagrammatic drawing of the inflated-fabric wing.

To further reduce the drag, we made the wing in a lighter material by dispensing with the aluminium protecting surface and "skinned" the whole wing with a very light silvered textile, thus covering the corrugations in the surfaces, necessarily there by the method of construction.

The elevons on the early prototype had been operated by orthodox wire pulleys and levers. These had imposed local loads in the surfaces and required further local loads applied by rubber cords, to achieve static balance.

To be rid of these difficulties we developed pneumatically operated full-span elevons which worked by means of inflatable tubes inserted near the root of the elevon hinges. When an elevon had to be moved, air was allowed to escape from one tube to atmosphere, while air from the wing was fed into the other. To make only one pair of wires necessary, the operating valve was situated at the inboard end of the elevon trailing edge and was spring-loaded to return the elevon to the full "up" position. This gave "feel" to the pilot, since he had to overcome the load in the spring before the elevon would move. To ensure that the elevons returned to the neutral position, a suitable spring was applied to the control wire at the pilot's end of the system. Incidentally, the whole aircraft, with the exception of the engine unit and wheel bearings, was of non-metallic construction.

It will be appreciated that when a pneumatic aircraft climbs there is an increase in the pressure difference and it is necessary to fit a safety valve. Conversely, when the aircraft descends, it is equally necessary to replace the air valved on the way up. This was done by means of a windmill-operated plastic blower, and, of course, in level flight made good the amount of air used by the control system, slight leaks, and so on.

As the aircraft had no tail unit, fixed fins were clipped on to the outboard ends of the elevons, to give maximum moment.

Before proceeding further, we decided to take the completed wing onto an airfield for towing trials, to determine among other things, the accuracy of our estimates of the mean centre of pressure and the lift/drag ratio of the wing alone. We were grateful to find that the tow-load, i.e., the drag, of the wing in level flight was somewhat lower than we had hoped.

Much encouraged, we then proceeded to build, what may best be described as the pilot's cabin and the wheel units.

The cabin was basically an air-inflated slab about 12-in. thick descending from the underside of the wing, with a forward projecting cylinder slightly longer than a man's leg. The whole slab was then faired in by an outer skin, complete with curtained doorway, and front and side windows of transparent flexible plastic sheet.

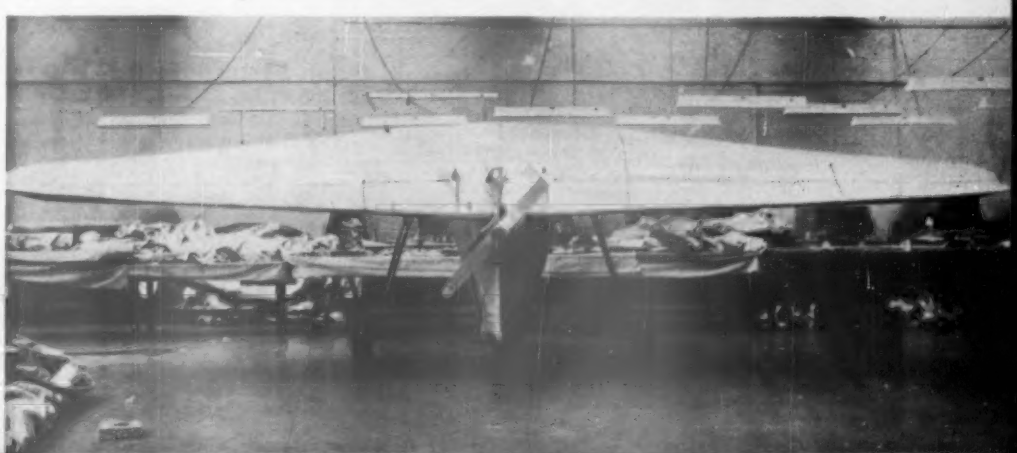
The pilot sat on the projecting cylinder of air with his back against the leading edge of the slab, to which a seat-belt was attached.

The outer skin was attached to the underside of the wing on an aerofoil profile and was tight enough to put the slab into compression, so that the local load imposed by the pilot's weight was distributed evenly along the attachment line. The pilot was virtually suspended in the outer skin.

Controls were all hand operated. A square sectioned column of the forked front wheel (plywood, and tyred with a deck quoit) projected upwards between the pilot's legs. On this was fitted a vertically sliding pair of handlebars, to the outboard end of which, descending from the roof, were attached the elevon cords. From the lower part of the column ran the cords operating the rudder, mounted behind the propeller.

To turn the aircraft left or right, one turned the handlebars as on a bicycle; to climb or descend one slid them up or down, and to bank, tilted them port or starboard. Not having flown an aircraft I wanted something fairly simple!

The throttle control was a friction-held sliding knob on the



This rear view of the inflated-fabric 6 h.p. single-seat delta shows the neat engine installation and clean lines of the design.

left-hand wall of the skin, whilst the ignition switch took a similar form on the right, with the additional feature that it could be pulled down like a communication cord, to hold the choke closed for starting.

The safety valve, which also served the purpose of inflation and deflation, was situated above and in front of the pilot's head, and could be manually operated if necessary.

To complete the cabin, two instruments were fitted. One was a pressure gauge reading to 2 lb./sq. in., and an airspeed indicator which read to a maximum of 35 m.p.h.

The undercarriage consisted of two streamlined spruce struts and a half-axle on either side of the cabin, the top end of the struts and the inboard end of the axle terminated on a plywood disc attached to the pressure surfaces, which supplied both springing and damping. All joints were quickly detachable single rope hinges.

The 6-in. by 20-in. wheels were made of 3-ply dinghy fabric and two plywood discs. The tread was applied in the form of about 100 coats of rubber solution, each wheel weighing 2 lb. and operating at 6 lb./sq. in. When deflated the tyres could be folded into the size of the discs.

The aircraft was now complete, and with ¾ gallon of petrol in the tank, weighed 167 lb.

For transportation by road, the aircraft was deflated and rolled up around the propeller and wheel struts, making a bundle 14 in. diameter and 4 ft. 3 in. long, whilst the engine unit was packed complete into a box 16 in. by 16 in. by 16 in.

The model of an Auster with inflated wing and fuselage, rigid cockpit and tail unit, built prior to the aircraft described, was capable of short hops.

Using a large domestic vacuum cleaner, it was possible to inflate the aircraft and be ready to fly in 25 minutes.

On Jan. 25, 1956, we took the aircraft to a disused airfield and began towing trials with a dummy engine, to collect data and generally test the structure.

On Mar. 7 wearing a crash helmet, and, I am assured, a look of great apprehension, I took my seat in the cabin and strapped myself in.

The engine was already warmed up, and since it was now too late to back out, I gave it three-quarter throttle and signalled the chocks away and immediately began to roll down the runway.

In about 150 yds. the A.S.I. was reading 23 m.p.h. and I very gently raised the front wheel, at least that was what I intended to do! In fact, it came up smartly and I found myself at an altitude of 4 ft. and rising fast. This was at least twice as high as I considered safe, and promptly pushed down too hard! The ground began to rush up towards me, and that part of my anatomy nearest the concrete began to warm up in anticipation. However, when I did touch down, it was almost imperceptible. The struts, cushioned on the wing, did their job well.

In the days that followed, I made quite a number of short flights, some of which were in a side wind, but I did not attempt any turns.

On one occasion I found myself at about 20 ft. up, with the control wires crossed. I spun down to the concrete at 45°. I drew my legs up in preparation and switched off the engine. As I hit the deck, everything folded up about my ears—and then, just as suddenly, straightened out again. I had felt nothing and the aircraft had sustained only slight abrasions on the front of the keel.

I mention this, as it is my firm belief that this type of construction could provide the safest type of light aircraft possible. Such aircraft are almost indestructible except by fire, the pilot is surrounded by compressed air bags and there need be few solids to injure the body.

The wings need only about a 4g load factor, mainly to keep good shape, since up loads of more than this only progressively fold up the wing-tips. This does absolutely no harm to the wing and since one must be rising in these conditions, one only need wait until they cease, for the wings to pop back straight again.

In conclusion may I attempt to dispel a popular misconception. Pneumatic aircraft are *not* susceptible to punctures in the air. The materials used are woven to make them almost untearable, and one hardly ever comes across nails and broken glass "up there."

Rolls-Royce and the By-pass Engine . . . .

(Continued from page 431)

These curves indicate that the by-pass engine offers a distinct advantage over the pure jet and that its by-pass ratio should lie between 0.7 to 1.1, the actual value being determined by noise requirements. Although jet noise decreases with increasing by-pass ratio (all other parameters remaining the same), intake noise will become more severe.

Fig. 3 contains two curves, one labelled "mixed exhaust," the other "separate exhausts." Rolls-Royce has always felt that there should be only one efflux from the engine (and indeed also that all the air should be taken in by a common intake). This is, in their view, obviously the correct way to design an engine, giving the minimum of installational problems and avoiding the need to install more than one thrust reverser. All Rolls-Royce by-pass engines, therefore, carry the by-pass air to a point behind the turbine and direct this air into the main jet pipe.

If this mixing process can be carried out efficiently, it is possible to improve performance. The propulsive efficiency with a substantially constant efflux velocity is better than with hot and cold streams at different velocities. For a by-pass ratio of 1, a theoretical improvement of over 4% in cruise consumption is achievable; in practice, an overall improvement of just over 2% can be achieved.

Mixing is impossible on engines designed without a by-pass duct or where the design is an adaptation of an existing engine. The broken line on Fig. 3 indicates the penalty incurred.

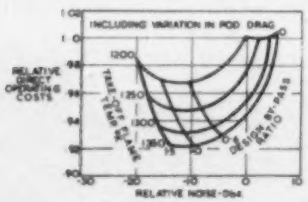


Fig. 4. Effect of turbine inlet temperature and by-pass ratio on operating economics.

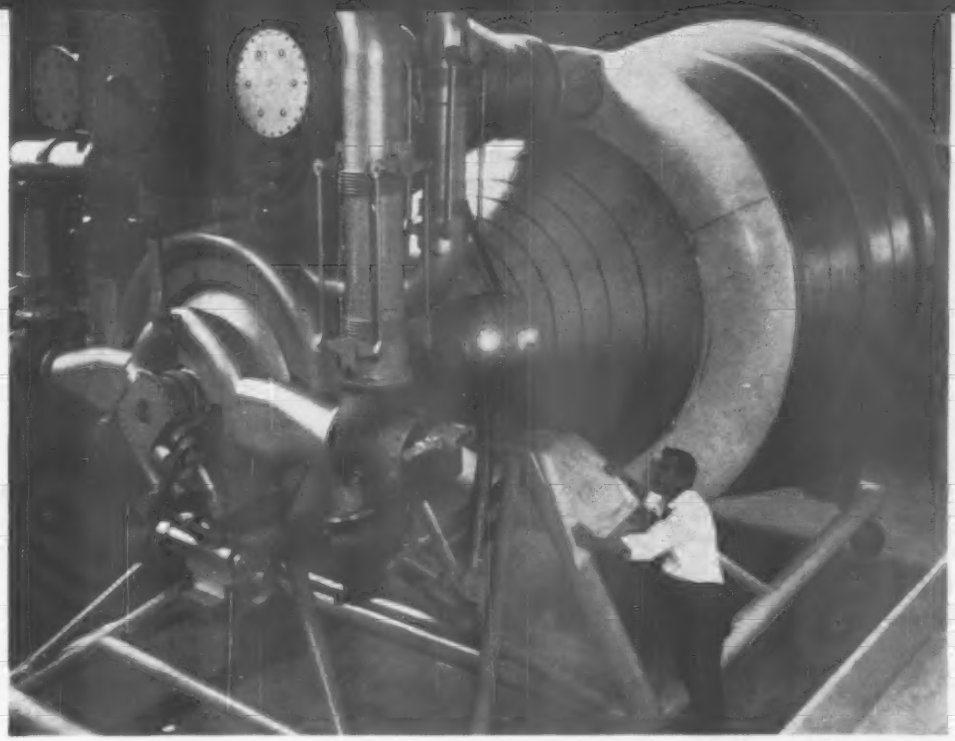
The first year of jet transport operation has shown that measures to reduce jet noise on take-off have provided a lower perceived noise level than the worst piston-engined transports, but this has not been sufficient to avoid a public annoyance. The losses were also disappointingly high. Substantial progress is required and the noise level laid down by B.E.A. for the De Havilland D.H. 121 represents a tremendous step forward in noise control. As already mentioned, it is 100 PNdb. 2½ miles from the start of the take-off run. A high initial rate of climb for the aircraft is an essential part of exhaust noise control.

Intake noise during the approach is as important as exhaust noise. Analysis of intake noise measurements shows that the by-pass engine will be no noisier than the pure jet. The "fan" engine, however, appears to have a higher intake noise, of the order of 5 db. or more because of the higher stage loading; it will probably be even more with a high fan tip speed.

Mixing the hot and cold gas flow of a by-pass engine gives a lower uniform outlet velocity and is worth about 5 db. on an engine designed to accommodate mixing.

Probably the main lesson that has been learned from Rolls-Royce experience and theoretical studies on by-pass engines is the advantage to be gained by operating at high turbine inlet temperatures.

Fig. 4 shows the effects of turbine inlet temperature and by-pass ratio on operating economics. Increasing the turbine inlet temperature becomes more beneficial as by-pass ratio is increased. By the middle of 1963 Rolls-Royce will have accumulated over two million hours service experience with cooled turbine blades; these have been under development since 1948. But the advantages of high flame temperatures can be easily offset by inefficient use of the cooling air; the techniques cannot be evolved overnight. Rolls-Royce plan to operate the new family of by-pass engines at temperatures as high as are compatible with satisfactory blade life. They will start service at blade metal temperatures within service experience with Dart, Avon and Conway engines.



This mock-up, left, gives a good impression of the size of the F-1 rocket engine which will produce 1,500,000 pounds of thrust. Note the massive "feed lines" which must cater for a propellent flow rate of nearly 3 tons/sec.

Powerplant for Nova

EIGHT MONTHS after the National Aeronautics and Space Administration placed a contract for the F-1 single-chamber rocket engine to give a thrust of 1.5 million lb., an uncooled test unit had been successfully run at a thrust exceeding 1,000,000 lb. The test occurred last summer at Rocketdyne's Propulsion Field Test Laboratory in the Santa Susana Mountains, near Los Angeles.

This early start was largely the result of research, which the Rocketdyne Division of North American Aviation had begun five years before, in anticipation of the need for engine thrusts in the "megapound" range. A U.S.A.F. contract supported this work under the project name REAP (Rocket Engine Advancement Programme).

Conventional Design

To ensure maximum reliability and keep development time to a minimum, NASA stipulated that the F-1 engine should be of conventional design to take full advantage of experience with existing high-thrust propulsion units. For this reason, the big Rocketdyne engine will use the same bi-propellent combination as current operational engines which power Thor and Atlas, RP-1 (kerosene-type fuel) and liquid oxygen. Despite this, it will be four years before the new propulsion system can be ready for launching in a rocket.

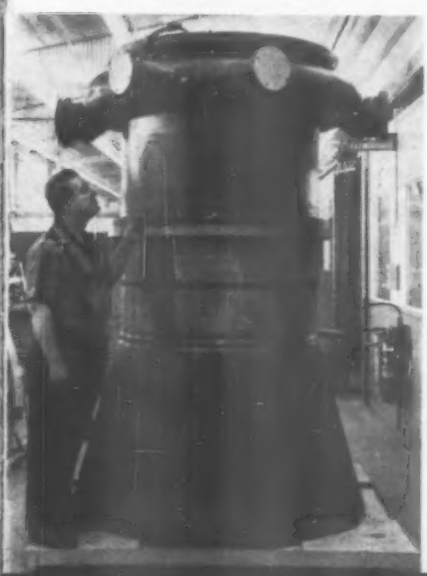
Full-scale testing of the F-1 will be conducted on U.S.A.F. facilities now being constructed on the rocket propulsion and missiles area, at Edwards AFB, California. The stage reached in the programme to date is that a full-scale mock-up has been completed; stable combustion has been achieved at more than 1,000,000 lb. thrust in a full-scale, uncooled, combustion chamber, and tests of model fuel and oxidant pumps have verified design criteria for the full-scale unit. A turbo-pump, with a delivery rate of about 3 ton/sec., is in an early development stage, and design of the turbo-pump gas generator has been finalized in the light of preliminary research.

Project Nova

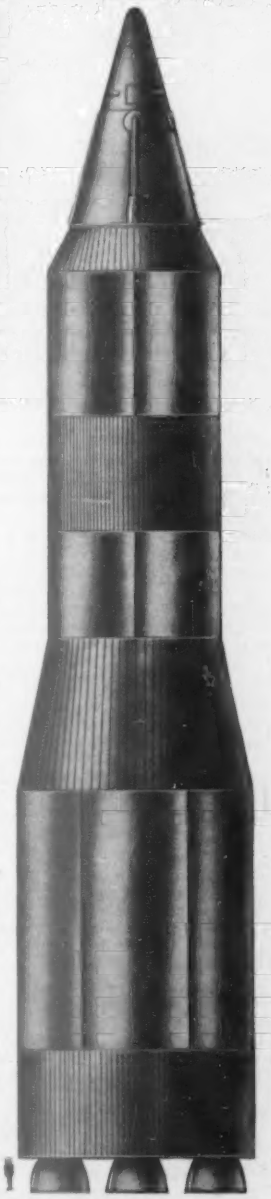
Although precise applications have yet to be settled, the engine is expected to be used in clusters to form a heavy-duty space-booster. This is the celebrated Nova project.

Clustering of F-1 chambers will provide units developing thrusts for 6-12 million lb These, according to NASA, could form the basis of a multi-stage vehicle capable of landing men on the Moon and returning them to Earth. The mission capability of a six-engine first stage includes orbiting 290,000 lb. at 300 miles; orbiting 60,000 lb. at 22,300 miles (the 24-hr. equatorial orbit), and launching 100,000 lb. to the Moon.

Nova is generally regarded as being about the maximum practical size for space-vehicles using purely chemical propellents. Beyond this size it would be more economical to turn to nuclear propulsion. Nevertheless, if all goes well, Nova is expected to serve well into the 1970s, and it would not be surprising if a version ultimately appears which embodies a nuclear second stage.—K.W.G.



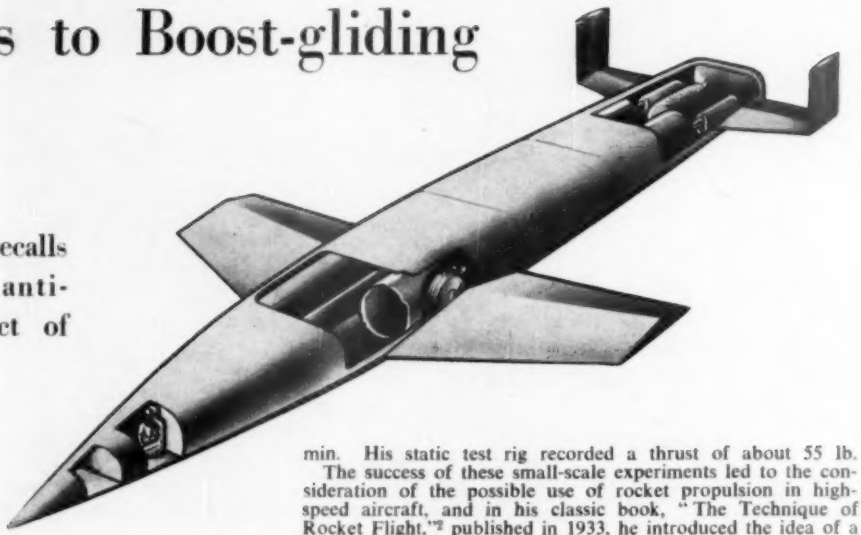
Uncooled test device for the F-1 rocket engine which has already exceeded a thrust of 1,000,000 lb.



Drawing copyright "The Aeroplane and Astronautics"

Scale drawing of the projected Nova space-vehicle which would stand 220 ft. high. Six Rocketdyne F-1 rocket engines are embodied in the first stage.

First Steps to Boost-gliding



KENNETH GATLAND recalls the Sänger-Bredt anti-podal bomber project of 1936-42.

ONE of America's most ambitious and far-reaching space-programmes concerns the development of a vehicle which, in operation, will combine the high speed of a ballistic missile with the controlled and accurate flight of a manned aircraft. This is the Dyna-Soar project, a joint undertaking of the U.S. Air Force and NASA. The name is a contraction of the words "dynamic" and "soaring"; essentially it means that the vehicle will utilize both centrifugal and aerodynamic lift forces. The ultimate aim is controlled orbital flight.

Dyna-Soar thus represents a stage beyond the Mercury project in which attempts are to be made to put a man into orbit within a ballistic capsule. Once ejected from orbit, the latter will re-enter the atmosphere along a path which, although predictable, cannot be altered either by the vehicle's human occupant or by remote control. With the former, manœuvrability and pilot discrimination go hand in hand.

In America, Dyna-Soar is widely regarded as the forerunner of new techniques in bombing and military reconnaissance. The fact that such vehicles may enter orbit as manœuvrable and recoverable satellites suggests that they will also find application in the servicing and supply of space-stations.

Surprisingly, the concept of the boost-glider is nearly 30 years old and owes much to the Austrian engineer and physicist, Dr. Eugene Sänger, who became interested in the prospects of long-range rocket-flight while working at the University of Vienna in the early "thirties."

Sänger began by experimenting with small bi-propellent rocket motors of his own design. A typical example had a spherical combustion chamber of about 2 in. diameter and a flared nozzle 10 in. long[1]. Surrounding the chamber was a cooling jacket through which the fuel circulated prior to injection. The walls of the combustion chamber itself were lightly constructed and it was the cooling jacket, via the intervening fluid, that served to contain the combustion pressure. The theory was that the thin-walled combustion chamber would have a good heat transfer to the cooling medium and that the thicker outer wall, being cool, would resist the combustion pressure more readily.

In testing this unique little motor, Sänger used a light fuel oil which he injected at high pressure into the chamber jacket by means of Bosch pumps of the type used in diesel engines. Gaseous oxygen was fed directly into the combustion chamber from a conventional oxygen cylinder with suitable reducing valves.

With this device, Sänger achieved remarkable burning times. These were frequently 15 min. and sometimes more than 20 min. His static test rig recorded a thrust of about 55 lb.

The success of these small-scale experiments led to the consideration of the possible use of rocket propulsion in high-speed aircraft, and in his classic book, "The Technique of Rocket Flight,"[2] published in 1933, he introduced the idea of a rocket aircraft which, propelled to high speed at the fringe of the atmosphere, could be made to glide freely for great distances. The flight plan he subsequently evolved was for the aircraft to pursue a ballistic trajectory which transformed into an undulating path at the top of the denser atmosphere—the sort of path that a flat stone might follow in skipping across the still waters of a pond.

It was largely as a result of his book and other technical contributions that, in 1936, Sänger was invited to Germany to continue his work under the auspices of the Hermann Goering Institute, the research establishment of the Luftwaffe. There, he was entrusted with the formation of a research centre at Trauen for the purpose of developing his own original ideas on the long-range rocket aircraft. The research programme was to cover a period of 10 years and the centre became known as "The Research Institute for the Technique of Rocket Flight."

By 1939 the Institute was almost complete. It included an office building, test shed, workshops, hydrogen laboratory, ozone laboratory, fuel shed, water supply, mess, accommodation, guardroom, etc.

The objectives of the programme were a far cry from the work Sänger had begun in Vienna with his baby 55 lb. thrust motor. Now, the aim was to develop a rocket engine with a thrust of no less than 100 tons, necessary for the propulsion of a 100-ton rocket bomber.

Research problems Sänger listed for consideration were as follow:—

(1) Airforces and the form of airframes at Mach numbers between 3 and 30; (2) gas flow with simultaneous chemical conversion of the flowing medium; (3) airforces in a large free path of the air molecules (extreme flight altitude); (4) fuel research, in particular the burning of light metals in dispersion and the properties of ozone; (5) research on materials, in particular the materials for liquid oxygen pumps and long-life combustion chambers.

(6) Construction of a high-pressure steam-driven turbo-pump for fuel and oxygen; (7) construction of ignition equipment for the rocket engine; (8) development of a combustion chamber capable of withstanding extreme gas temperatures at 50 to 100 atmospheres pressure, with water cooled walls and internal steam cooling; (9) development of a supersonic catapult device for long-range rocket aircraft; and (10) development of mathematical theory and calculation of trajectories for long-range rocket aircraft.

In formulating the design of his pioneer boost-glider, Dr. Sänger was joined by Dr. Irene Bredt, the brilliant woman mathematician, who is now his wife. With a small team of

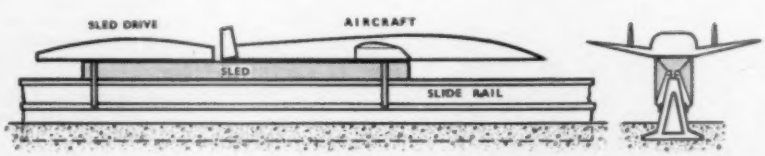
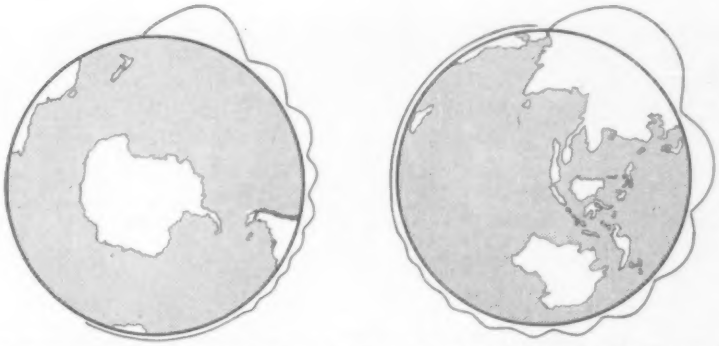


Diagram showing the proposed method of launching the antipodal bomber along a railed track nearly two miles long by means of a powerful rocket-sled.



Boost-glide trajectories as envisaged by Sänger for the antipodal rocket bomber. Rising like a ballistic missile and falling back into the atmosphere at high speed, the aircraft would follow an undulatory trajectory, such as a flat stone might follow when skipped across the surface of a pond.

technicians, various features of the design were painstakingly evolved and a surprisingly large amount of practical work was accomplished.

The aircraft itself appeared in the designs as a low-wing vehicle with vertical stabilizers at the tips of the tailplane. The wing-section was that of a thin wedge with sharp leading and trailing edges. The wings had an area of 481 sq. ft.

Perhaps the most unusual feature was the fuselage which was entirely flat on the underside, having an area of 870 sq. ft. Two oxidant and two fuel tanks, placed side by side, occupied more than two-thirds of the fuselage length. In the extreme tail was the water-cooled rocket engine of 100 tons static thrust.

The suggested launching procedure was also unique and not a little startling. It was proposed to have the 100-ton aircraft

SÄNGER-BREDT ANTIPODAL BOMBER PROJECT

Fuselage length	91.8 ft.
Fuselage width (max.)	11.8 ft.
Fuselage height (max.)	5.9 ft.
Wing span	49.2 ft.
Launching weight	220,500 lb.
Propellent weight	198,450 lb.
Payload weight	672 lb. plus pilot (min. for max. range)
Thrust	220,500 lb. × 480 sec.
Velocity (max.)	20,150 ft./sec.†
Altitude (max.)	93 miles
Range	14,600 miles (with min. payload)
Propellent	Liquid oxygen/gas-oil and water
Feed system	Turbo-pumps, steam-driven (water jacket of coiled tubes surrounding combustion chamber)
Control	Conventional pilot-operated aerodynamic surfaces
Guidance	Star-tracking at beginning of glide
Ground booster: Track length Sled thrust	1.8 miles 1,345,000 lb. × 11 sec.

† Based on a rocket engine with an exhaust velocity of 9,800 ft./sec. To circumnavigate the globe and return to land at the starting point would, it was calculated, require an exhaust velocity of 13,100 ft./sec., and a maximum velocity of 4.4 miles/sec.

take off from a railed track, almost two miles long, under powerful boost from a rocket-propelled sled. This "tethered" booster would bring the vehicle to a ground speed of Mach 1.5 before release.

Leaving the track the aircraft would then be made to climb under momentum at an angle of 30°, reaching a height of some 5,500 ft. before its own rocket engine fired. Under propulsion, the aircraft would climb less steeply and, following the climax of thrust, would coast to a height of nearly 100 miles before falling back on a ballistic trajectory.

However, instead of re-entering the atmosphere immediately, the dive would be terminated at a height of about 25 miles, whereupon the machine would follow a wave-like trajectory of decreasing amplitude at the fringe of the effective atmosphere. It was thought that equilibrium between heat intake due to friction and radiation could be maintained by means of a strongly radiating skin.

Using the "skip" technique, it was estimated that half-global (antipodal) and even full-global missions could be flown by a hypersonic aircraft of this type, and one of the targets considered in the design exercise was the city of New York. The great problem, however, was that even with the high performance assumed of the rocket engine and the airframe, the load-carrying capacity was small, only 672 lb. over a range of 14,600 miles. In these days of small nuclear weapons, such a payload might be quite adequate but, in terms of chemical high-explosive, it was disproportionate to the all-up weight.

Although Sänger and Bredt regarded their work as a purely preliminary study, it was continued right up to the summer of 1942 when, as Sänger relates, "the long-term programme came into conflict with the prosecution of the war." The work had been increasingly hindered by the call-up of personnel, including those of participating industry, added to which the acute shortage of such materials as nickel, copper and chrome, proved an overwhelming handicap.

Nevertheless, by that time, Sänger's Trauen research centre had facilities for testing a one-ton experimental gas-oil/liquid-oxygen rocket engine. This used continuous water cooling through pipes which were tightly coiled around the entire length of the combustion chamber.

Moreover, development had progressed sufficiently for work to begin on a full-scale rocket engine of 100 tons s.t., and at least a mock-up cooling system was built consisting, as before, of tightly coiled tubing. There was also developed a prototype liquid oxygen pump with a capacity of 4 litres/sec., working against 150 atmospheres. The layout of this engine in the proposed antipodal bomber was illustrated in THE AEROPLANE AND ASTRONAUTICS, Oct. 9, 1959, p. 318.

The Institute boasted in addition the largest liquid oxygen storage tank in Germany with a capacity of 50,000 kg. (110,250 lb.).

Soviet Interest

Before the programme was finally terminated, Sänger had undertaken work on the Lorin ram-jet engine which it was hoped to employ for the propulsion of interceptor aircraft. Again, this work failed to find practical application during the War although projects were in being.

The record of the ambitious Sänger-Bredt antipodal bomber project was contained in a comprehensive top-secret report[3] which had a limited circulation among various research establishments in Germany, such as Peenemunde, and among certain high officials. When the War ended, copies fell into the hands of the major Powers, including Russia, and according to Col. G. A. Tokaev, a Russian officer who defected to the West in 1948, it created considerable interest in the Kremlin. Tokaev said its contents were discussed in April, 1947, at a conference attended by Stalin, his son Vassili, Malenkov, Beria, Voroshilov, Voznesenski, and two scientific advisers, a Col. Serov and Tokaev himself.

This episode in the story of the antipodal bomber is related in the book, "Stalin Means War,"[4] published in 1951, Stalin's interest in the project is said to have been its long range as compared with that of the V-2 rocket.

Following the meeting in the Kremlin, Tokaev, Col. Serov and Vassili Stalin were said to have departed from Moscow

One of a variety of boost-glider configurations being tested in NASA wind-tunnels. More recent studies appear to favour the high-lift high-drag body with minimum wing surfaces.

with orders to find Sänger and bring him to Russia. But Sänger, working quietly in France, was never found.

Whether or not this initial Soviet enthusiasm for the boost-glider has led to an active project is open to conjecture. A rumour that it had was circulating in January. (THE AEROPLANE AND ASTRONAUTICS, Jan. 29, 1960, p. 124.) However, it is plainly evident that the purely ballistic rocket was not ignored, despite Stalin's alleged misgivings.

The Americans, for their part, have the Dyna-Soar project. Although the outcome may differ widely from the vehicle worked out in such detail by Sänger and his associates so many years ago, the pioneer work at Trauen showed the way to a remarkable future in hypersonic flight.

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(1) Ley, W. "Rockets, Missiles and Space Travel," Chapman and Hall, 1957.

(2) Sänger, E. "Raketenflugtechnik," R. Oldenbourg, Munich, 1933.

(3) Sänger, E., and Bredt, I. "A Rocket Drive for Long-range Bombers," Deutsche Luftfahrtforschung UM 3538, Ainring, Bavaria, 1944. Translated by M. Hamermesh, U.S.N., published at $3.95 by Dr. R. Cornog, 990 Cheltenham Road, Santa Barbara, Cal., U.S.A., Nov., 1952.

(4) Tokaev, G. A. "Stalin Means War," Weidenfeld and Nicolson, 1951.

Dyna-Soar Dilemma

SECOND thoughts on the configuration of Dyna-Soar, whether in fact it should have a semi-ballistic shape or the form of a winged glider, have been expressed by NASA and U.S.A.F. officials in recent months. To resolve these and other difficulties, a four-day conference will be held at Langley Field, Virginia, on Apr. 11-14 between U.S.A.F. and Government officials and representatives of the various manufacturers.

The first two days will be reserved for discussions on general problems concerned with the boost-glide technique. These will embrace aerodynamics, heat transfer, stability and control, instrumentation, structures and materials. Specific configurations for boost-gliders will be the subject of the next two days' deliberations, with reference to the development of practical re-entry structures. Sub-systems will also be debated, including instrumentation and navigational equipment.

Questions likely to arise concern the merits of high-lift high-drag vehicles such as the half-conical re-entry vehicle proposed by A. J. Eggers, Jnr., which would allow reasonable manœuvrability in manned vehicles at high speed. This type of vehicle is being set against the winged hypervelocity glider, which is believed to have been favoured to date in the Dyna-Soar project, a joint undertaking by NASA and the U.S.A.F. with Boeing and Martin as prime contractors.

One of the aims of the forthcoming conference will be to re-examine the respective merits of these two basic concepts and determine what precisely are the military tasks the final vehicle might perform. Since little advantage is gained from the use of wings, with their added weight, above Mach numbers of 5.0 and 7.0, some authorities feel that a device on the lines of the Eggers "half-cone," embodying small wing-like surfaces, might have as much manœuvrability as some conventional winged vehicles at hypersonic speed.

This, broadly, was the conclusion reached by Dr. W. F. Hilton and Mr. H. R. Watson of Sir W. G. Armstrong Whitworth Aircraft, Ltd., in their "pyramid" project for a manned satellite vehicle, presented at last year's Commonwealth Spaceflight Symposium.

Blue Streak and Satellite Communications

LECTURING on "Ballistic Vehicles" before the Hatfield Branch of the Royal Aeronautical Society on March 30, Mr. G. K. C. Pardoe, project office manager, de Havilland Propellers, Ltd., began by surveying problems involved in developing the long-range ballistic missile. He dealt in turn with the total vehicle system, ballistic trajectories, test equipment, handling and transport, servicing and launching, and ground-support equipment.

A large part of his paper, however, was concerned with the application of Blue Streak and Black Knight as a satellite launcher and, in particular, its use in the technological development of spaceflight. In this context, he thought the communication satellite worthy of serious study. The Americans had already placed a primitive communication satellite in orbit (Project Score) and were on the verge of placing a more refined payload in space specifically designed to provide World communication facilities.

Within one or two years at the most, said Mr. Pardoe, the Americans would have established some form of satellite communication system in orbit, and although this would be "owned" by the U.S. Government, it was not difficult to see that before long such a system would be improved and adapted, and be given widespread civilian use. It was not likely that America would share such attractive commercial projects with another country (as opposed to military projects on which we were to some extent inter-dependent) and any widespread use of a monopolized satellite audio or video signal transmission service, on a commercial scale, would have serious repercussions on the British Cable and Wireless, Ltd., nationalized corporation.

The landline and submarine system could become obsolescent in the immediate future, and the transfer of business to the satellite system—with its greater potential of higher quality and utilization—would undermine the whole section of British activity, unless we could follow up quickly with a comparable system.

The Blue Streak and modified Black Knight space-vehicle currently under consideration for a British satellite programme, would be quite capable of projecting large enough payloads into orbit to form a communication network. Mr. Pardoe expressed the hope that the reality of this situation would be fully taken into account by the Government in reaching their decision. In his view, the Postmaster-General, the B.B.C., and the relevant sections of the electronics industry, would do well to study the problem and lend their support to the plan for British activity in this field.

NASA's Space Programme

PRESENTING NASA's $915,000,000 budgetary request for fiscal year 1961 before a Senate sub-committee on Mar. 28, Dr. T. Keith Glennan said that the rocket launching programme envisaged was as follows:—

Scout, the relatively low-cost, utility, vehicle would be fired for the first time this summer. Thor-Agena B launchings by the Department of Defense would begin at about the same time. For the next year or so, NASA would use a less powerful interim vehicle in this general class, the Thor-Delta, scheduled for initial launching this month. Atlas-Agena B is being used by the Department of Defense this year and by NASA in 1961.

In the high-performance class, Atlas-Centaur, using liquid hydrogen/liquid oxygen in the second stage, is expected to be test-fired in 1961.

If NASA is granted the full budgetary request, the following schedule should be possible for the Saturn 1.5 million lb. s.t. booster: static test of the eight-engine cluster, spring 1960; launch of the first stage with dummy upper stages, summer 1961; launch of the two-stage vehicle, autumn 1962; launch of the three-stage vehicle, late 1963. The first operational vehicle would appear before the end of 1964.

Looking even further down the road—and another billion-plus dollars into the future—NASA expects to have the Nova vehicle, consisting of a cluster of Rocketdyne F-1 engines, with a total thrust of 6-12 million lb., sometime after 1965 (latest details of this powerplant are on page 435). Dr. Glennan said it was proposed to increase the funds for the F-1 engine from $24,200,000 in the 1960 fiscal year to $41,000,000 in 1961.

Satellite Instrumentation

A ONE-DAY introduction to the field of rocket and satellite instrumentation will be given at a joint symposium being organized by the British Interplanetary Society and The Society of Instrument Technology at Manson House, Portland Place, W.1, on Sept. 1, 1960. Particular emphasis will be given to work actually in being, or projected, in the United Kingdom during this year.

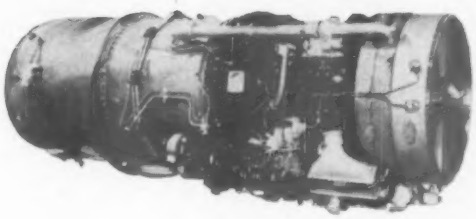
One paper will survey work already in progress on instruments for the British satellites expected to be launched by the American Scout rocket beginning in 1961. Complementary papers will deal with very high altitude environment measurements and the actual design of instruments. It is also hoped to release details of a design study of a communication/reconnaissance satellite.

In addition, consideration will be given to various problem areas within the field of rocket instrumentation, such as those involved in measuring rocket performance, and also the analysis of results by digital methods.

The full fee for the symposium is £2 2s. A limited number of students receiving full-time education will be charged a reduced fee of £1. Registration forms can be obtained from the Secretary, British Interplanetary Society, 12 Bessborough Gardens, London, S.W.1.

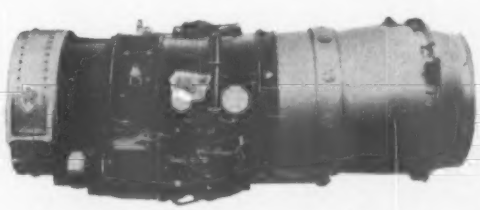
ROLLS-ROYCE BY-PASS JETS

designed for maximum operating economy

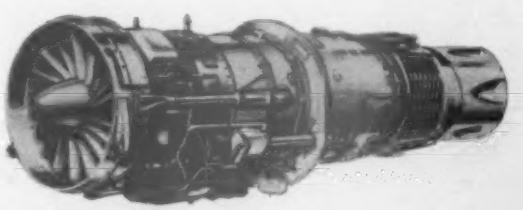


Conway by-pass jets will enter service this year in Boeing 707-420 and Douglas DC.8 jet airliners at 17,500 lb. guaranteed minimum thrust. The Civil Conway is being developed to powers over 20,000 lb. thrust with improved fuel consumption and will power the Vickers VC.10.

THE BY-PASS PRINCIPLE PROVED BY THE CONWAY IS NOW GENERALLY ACCEPTED AS THE CORRECT FORMULA FOR JET TRANSPORTS



The RB. 141 of 15,000 lb. guaranteed minimum thrust will power later versions of the Sud Aviation Caravelle.



The RB. 163 of 9,850 lb. guaranteed minimum thrust has been chosen to power the Airco DH.121.

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At London Airport
Esso refueller crews handle

50,000,000 GALLONS OF FUEL A YEAR

AIRPORTS and refuellers are window displays. Both are the "end products" of an attitude towards life. A traveller's glance at London Airport tells no more about the English character than the sight of a refueller can tell him about the calculated hustle that animates Esso.

"Calculated hustle" needs explanation. Three years ago six men took 25 minutes to fuel a DC-6 with 5,000 Imperial gallons. The new Esso Python, manned by only two men, can supply 12,000 gallons to a Boeing 707 in 12 minutes. Calculated hustle explains the difference.

Hustle is not haste, which gives an impression of urgency, backed by inexperience. Calculated hustle means a near-surgical swiftness born of training, planning and anticipation, with a solid background of scientific research.

It begins slowly. Take the training of a refuelling crew for example. For two months or more a new man works under the close supervision of his crew chief before he can qualify as a fully fledged crew member. He receives practical and theoretical instruction from a man wise in the ways of fuelling aeroplanes, and whose experience is kept up-to-date by courses at Esso's training school.

Then there is quality control, a progressive system of checks, all of which contribute to the speed, safety and efficiency of the final operation. From the refineries and ocean-side storage tanks, aviation fuel — already tested to rigid specification — is delivered by road to Perry Oaks, the fuel farm at London Airport where more than a million gallons of fuel are stored. There it is sampled and filtered before delivery to Esso's satellite depot, with tankage for another half-million gallons, at L.A.P. Central.

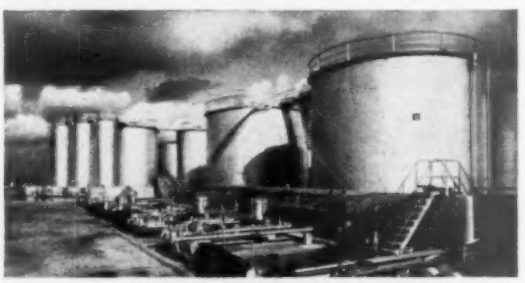
From these tanks it is fed to the refuellers after more checks and filtration. And each refueller is inspected daily, an inspection which includes all its safety equipment as well as final tests to make certain that its load of aviation fuel is free from contamination.

Quality control is backed by the experience and ultra-modern facilities of a first-class research organization. Esso's scientists look towards tomorrow but keep an eye on the run-of-the-mill problems of to-day. Not only do they experiment for the development and improvement of Esso's future products: they analyse and test samples of current fuels and oils and devise test procedures and equipment for use in airport tests for fuel cleanliness.

L.A.P. Central Area from the air. The S.E. face passenger handling building is at the centre, the Eastern Apex building on the right.

Advance planning is another factor. Every day a schedule is compiled in Esso's operations room at London Airport Central, giving estimated times of arrival and probable fuel requirements for each aeroplane needing Esso service in the following 24 hours. And an up-to-the-second communications system keeps Esso's controller in touch with latest developments so that he can direct the refuellers accordingly.

So much for the background. Trained crews are ready. Product has been tested all down the line. The programme is planned. Refuellers have been checked and are waiting to swing into action.



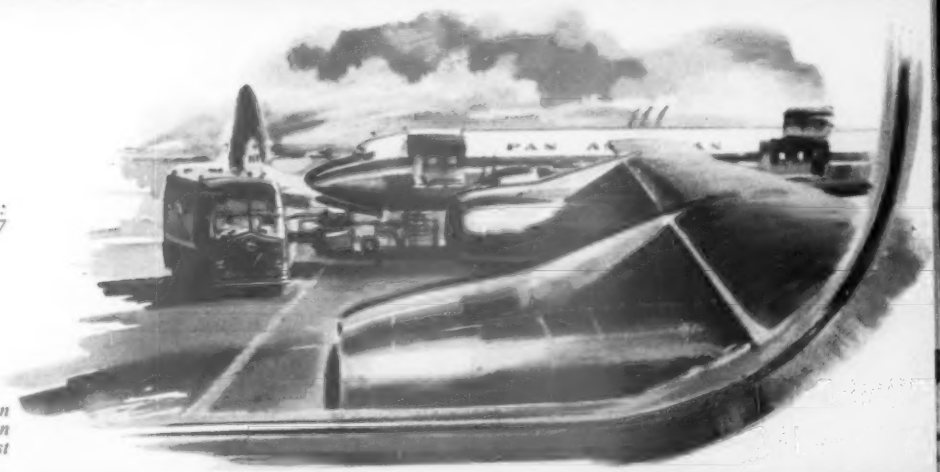
Part of the one million gallons of tankage which constitutes Esso's fuel farm at Perry Oaks, adjoining London Airport.

An incoming airliner, still some distance away, is reported by Air Traffic Control. Esso's controller is informed by teletype direct from the tower or by landline from the operator. The controller alerts the appropriate refueller crew either directly or by radio via the apron supervisor. In less time than it takes to tell, the refueller is on its way to the arrival area. Soon the aircraft taxies in and rolls to a halt. Within three minutes refuellers and other servicing equipment are correctly positioned, all safety precautions have been taken, hoses deftly and swiftly coupled, and the fuelling operation begins under the watchful eye of the apron supervisor.

Perhaps the airliner is one of the big jets, thirsty and impatient after a trans-Atlantic flight. Then the refueller will be the Python, huge, red and dependable — a big answer to a big need. For other aircraft or lesser requirements, smaller special-purpose refuellers may be more suitable, like the 6,000-gallon Pluto. Whatever the aeroplane and whatever its need, the appropriate vehicle will be there, ready to supply what is wanted, where it is wanted and just when it is wanted. That is the principle of Esso service, applied with characteristic hustle which is Esso's speciality. That is how customers are satisfied and why Esso's business is expanding at London Airport.

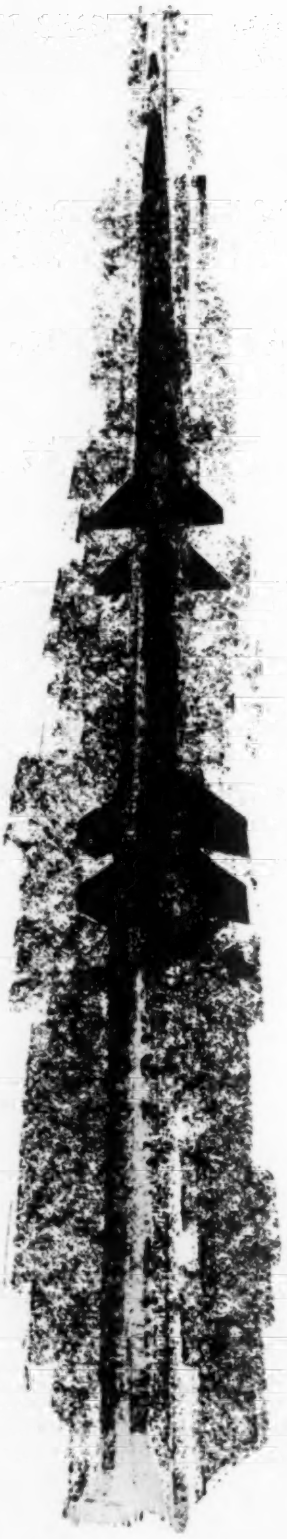
Calculated hustle enabled the refueller crews to supply 30,000,000 gallons of aviation fuels to Esso customers last year at London Airport alone. This year's estimate is over 50,000,000 gallons. As for the future—when Esso development and research evolve still better fuels and oils, and when a pipeline links the mighty Fawley refinery to London Airport—new requirements will be met safely and swiftly in the same tradition as they are to-day, in the spirit of calculated hustle that a passenger may casually notice but a glance will never explain.

Esso Petroleum Company Limited,
Aviation Division,
36 Queen Anne's Gate, London S.W.1
Telephone: RELiance 1261



At the receiving end of calculated hustle: view from a cabin window of a Boeing 707 on the fuelling apron.

1615 on a winter's day at London Airport. A Boeing 707 of T.W.A. en route Frankfurt-New York receives fast Esso service.



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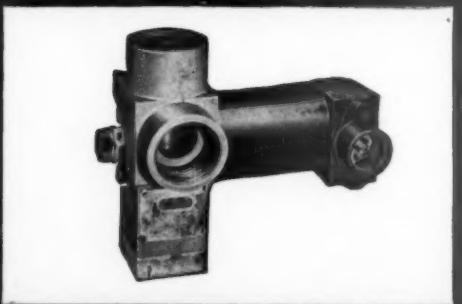
Solenoid Valves Designed for the control of hot air bled from the engine compressor, this direct current solenoid valve is used for such purposes as jettisoning of fuel, engine bay ventilation, supply to the de-icing system and similar applications where high flow at engine compressor temperatures is required and a small leakage of the closed valve is permissible. The MD. 32/1 for 150 p.s.i. working pressure weighs 1·65 lb., is rated at 0·61 amp. at 24V 20°C. Flow is 9·61 lb/min at 105 p.s.i (gauge) inlet. Temperature range is −65°C to +365°C.

...by *Hymatic*



Other products, the design and precision manufacture of which have established Hymatic as leading engineers in the aircraft equipment field, include

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189

THE HYMATIC ENGINEERING COMPANY LIMITED REDDITCH · WORCESTERSHIRE

Canadian Basic Trainer

Howard Levy photographs

Above, the Canadair private-venture CL-41 basic jet trainer, designed to meet R.C.A.F. requirements, shows off its paces near Montreal alongside a T-33 Silver Star.

Above, fuselage mounted dive-brakes on the CL-41 are 3.4 sq. ft. each and have a maximum deflection of 50°; design dive speed is Mach 0.8. Below, the 55-in. wide cockpit has full dual control with electrical and radio controls on a centre console.

Above, oxygen, radio, battery and electrical gear is housed in the nose with access through large doors on each side. Below, debris screens are fitted over the air intakes and open when the landing gear retracts.

Aviation News in General

Tu-114 RECORDS.—Subject to F.A.I. homologation, a Tu-114 has broken eight world speed/payload records during a flight on Mar. 24 over a 612-mile (1,002-km.) Moscow - Orel - Moscow circuit. Carrying a payload of 25 tonnes, the Tu-114 completed the flight at an average speed of 541 m.p.h. (871.4 km./h.). The records are for speed over 1,000 km. with payloads of 1, 2, 5, 10, 15, 20 and 25 tonnes and for speed without payload.

BOEING-VERTOL.—The Vertol Aircraft Company became a division of the Boeing Airplane Company on Mar. 31.

KAMAN AFFAIRS.—During 1959 total sales by Kaman Aircraft Corpn. are reported to have been $34,747,000—over $13 million higher than the previous year's figure. Employment has now passed the 3,000 mark.

LOCKHEED SALES.—During 1959 missiles and space vehicles accounted for more than half of the Lockheed Aircraft Corporation's sales, which totalled nearly £465 million.

NEW ADDRESS.—From Apr. 13, the new address of Fison-Airwork, Ltd., will be Redhill Aerodrome, Surrey. Tel: Nutfield Ridge 2353/4; telegraphic address: Bristow, Redhill.

EDINBURGH EXTENSION.—Space for two Vanguards and three Viscounts will be provided on the apron extension at Edinburgh Airport, work on which began recently.

FOR EXECUTIVES.—The Transportation Center at Northwestern University, Evanston, Illinois, is to hold a special five-week residential course on Executive Planning in Transportation, starting on April 17.

PILATUS DEMONSTRATED. — At Katmandu, recently, a Pilatus Porter built for the Swiss Himalayan expedition to Dhaulaghiri, was demonstrated from a 150-yd. strip laid out on the parade ground.

EXPEDITION POSTPONED. — Dr. Brennig James' proposed Himalayan expedition (THE AEROPLANE AND ASTRONAUTICS, Feb. 5, 1960) has been cancelled for this year. He is asking for a postponement until 1961.

CANADIAN TRANSPORT.—The third production Canadair-Convair CC-109 for the R.C.A.F. seen at the manufacturer's aerodrome at Cartierville. Ten are on order for the Service and the production rate is one per month.

ENGINES FOR SALE.—The South African Air Force is offering for sale by tender more than 80 Ventura P. & W. Double-Wasp engines, and about 80 propellers. This sale spells the impending disappearance from the S.A.A.F. of the American twin-engined Ventura bomber and reconnaissance aircraft, used since 1942.

HELICOPTER SPRAYMAT.—Napier and Westland are working on the design of a de-icing system for the Wessex based on the Napier Spraymat electrical system. Three sets of heaters for main and tail rotors are to be tested—one on the ground at Luton and the other two in flight tests in the U.K., this summer, and in Canada in early 1961.

EXECUTIVE HELICOPTER.—The Marley Tile Holding Co. has chartered an 8-seat Westland Whirlwind from Bristow Helicopters for three months for trial use as an executive transport between various of its U.K. factories.

STAVERTON DISPLAY. — An air show at Staverton Aerodrome on June 25 has been planned. The programme is expected to include V-bombers and jet aerobatic teams from the Royal Air Force. The Cheltenham and Gloucester branches of the R.A.F. Association are joint organizers of the display.

DOWTY EXHIBITS.—A hydraulic landing-gear assembly, a variable-pitch propeller and an engine fuel system will be among the Dowty exhibits at the British Exhibition to be held in New York between June 10 and 26.

SATURN TESTED.—First static firing of the eight-engine 1,500,000 lb.s.t. Saturn booster was successfully completed at the Army Ballistic Missile Agency's test facility at Huntsville, Alabama, on Mar. 28. A pre-test picture appeared in our issue of Mar. 25.

HARDENED TITAN.—The first Martin Titan ICBM squadron will become operational by Jne. 1, 1961, according to Maj.-Gen. Osmond Ritland, Commander, U.S.A.F. Ballistic Missile Division. Sites will be hardened.

POLARIS AGAIN.—A Polaris ballistic missile was successfully launched from the research ship, U.S.S. "Observation Island," on Mar. 29, seven miles offshore from Cape Canaveral. The missile was the first ship-launched test-vehicle to use the newly developed guidance system. Target was 900 miles distant near Puerto Rico.

VANGUARD ANNIVERSARY. — Launched on Mar. 17, 1958, the 6.4-in. dia., 3.25-lb., "grapefruit" satellite Vanguard I, achieved its second anniversary last month having traversed 281.5 million miles. It should remain in orbit at least 200 years. Energized by tiny solar cells, its 5 milli-watt transmitter continues to radiate signals.

MET. SATELLITES. — Following experience with Tiros, NASA hopes to develop a network of "weather satellites," one pursuing an equatorial orbit and six orbiting over the poles. Each portion of the Earth's surface would then be photographed twice every three hours.

BLINKING SATELLITE.—Plans to launch a satellite containing a flashing light have been announced by NASA. The vehicle will orbit at 800 to 1,000 miles. By photographing the flashes against the star background, the satellite's position should be determined within 50 to 100 ft., at a distance of 1,000 miles. Objective is precise determination of the Earth's shape and size.

THUNDERCHIEF PRODUCTION.—Following delivery of 75 Republic F-105B fighter-bombers to the U.S.A.F., the all-weather F-105D is now in production; the 18th of these aircraft can be seen in the foreground. The F-105D can be used for blind bombing with nuclear or conventional bombs; it is also armed with rockets, 20 mm. cannon and Sidewinder AAMs.

Howard Levy photographs

Commercial Aviation Affairs

COMETS BY NIGHT.—B.E.A. has been given Ministry permission to operate a "small number" of Comet 4B night services from London Airport. This approval follows B.E.A.'s development of noise-reduction techniques (see last week's issue, p. 407) and Ministry tests. The noise level has been reduced to the equivalent of 92 db., or less, outside the airport boundary. In the peak summer season B.E.A. will be making about 20 Comet night take-offs every week.

707S FOR EL AL.—As forecast in last week's issue (p. 414) orders have been placed by El Al Israel Airlines for two Conway-engined Boeing 707-420s with an option on a third. The two aircraft will be delivered in May, 1961, for entry into service in July.

DC-8 LEASE.—Cie. de Transports Aériens Intercontinentaux (T.A.I.) is to lease two DC-8s from Union Aéromaritime de Transport, the other major French independent operator, so that turbojet services between Paris and New Caledonia can be started in July—two months earlier than originally planned. Both carriers have DC-8s on order.

SILVER CITY AND B.T.C.—Government approval for the plans for participation by the British Transport Commission in Silver City Airways has been refused. The reason for the refusal is, it is understood, the programme of reorganization for the railways and B.T.C. which is now being prepared. The decision does not rule out prospects of continued rail-air collaboration.

VEHICLE FERRY CHANGE.—Silver City is to open a vehicle ferry service between Manston and Ostend, replacing the previous Lydd-Ostend service.

POOLING STARTS.—On Apr. 1 the agreement between B.O.A.C., Qantas and Air-India came into force. Services between the U.K., India, the Far East and Australia, as well as certain North Atlantic services, are now being operated on a pooling basis.

ANGLO-POLISH TALKS.—A permanent Air Services Agreement between Britain and Poland is recommended by the delegations which have been discussing civil aviation in Warsaw. The agreement will give B.E.A. and L.O.T. permission to extend their London-Warsaw services to other European points.

B.O.A.C. 707 PLANS.—Jne. 6 is now the planned starting date for B.O.A.C.'s Boeing 707 service to New York, at a frequency of three times a week. The first service to Montreal and Toronto will be on Jne. 18.

TURBOJET YEAR.—On Mar. 20 Trans World Airlines completed their first full year of 707 operations, carrying 814,000 turbojet passengers over 1,670 million passenger-miles with an average load factor of 77%. T.W.A.'s overall fleet average factor in 1959 was 70.5%.

BRITANNIA FOR EAGLE.—As forecast at the time of the Cunard deal (issue of Mar. 25, p. 358), Eagle Aviation have taken delivery of a Britannia 318 (ex-Cubana). Its layout is designed for 104 passengers in forward-facing seats.

AIR-INDIA DATES.—The Boeing 707 will go into service with Air-India on Apr. 20, between Bombay and London, and will open the London-New York route for this airline on May 14. The company took delivery of its third 707-420 on Mar. 23.

BACK TO SUBSIDY?—Capital Airlines of Washington has asked for a Government mail subsidy of 22.5 cents (1s. 7d.) per revenue aircraft mile as a means of dealing with its financial difficulties. If the subsidy is awarded it will be the first to be given to a major U.S. domestic airline since 1955. Capital had lost more than $6 million up to the end of 1959, with a net loss, for January and February this year, of nearly $4 million caused by weather and by loss of traffic due to recent accidents.

NEW ICAO MEMBER.—Yugoslavia has today become the 77th member state of the International Civil Aviation Organization.

BUSY MIDWAY.—F.A.A. figures for 1959 show that the busiest U.S.A. airport was Chicago's Midway with a total of 431,600 movements. Miami and Phoenix (Arizona) were second and third on the list with 348,038 and 316,670 movements respectively.

CORK PLANS.—The new airport for Cork, due to be provisionally ready for use by May 31, 1961, will have two runways, one 6,000 ft. and the other 4,300 ft. in length. Facilities will include high-intensity approach and lead-in lighting, ILS for the main runway, and VOR. Aer Lingus expects intitially to handle 30,000 passengers annually.

LONGER PRESTWICK.—The extension of Prestwick's main runway to 9,800 ft. was completed on Mar. 23. B.O.A.C. and T.C.A. expect to use Prestwick for turbojet operations in June.

NORTH STARS FOR SALE.—T.C.A. is offering as a package deal its fleet of 21 Canadair North Stars with spares and all the ground equipment necessary for immediate and sustained operation. Also redundant to T.C.A. after delivery of its DC-8 and Vanguard fleets will be 13 Super Constellation and nine DC-3s.

PERMANENT TERMINAL.—Conditional approval has been granted by the L.C.C. for the building of a permanent terminal and offices at the Cromwell Road Air Station. The upstairs offices of the new building will house B.E.A. reservation staff and equipment.

HELIPORT GUIDE.—The F.A.A. has published a Heliport Design Guide, intended to help local authorities planning to establish heliports for small or large helicopters. It costs 30c. from the Government Printing Office, Washington 25, D.C.

News About People

AVIATION SALES.—Mr. E. Trees has become assistant manager (sales), Aviation Department, Shell-Mex and B.P., Ltd., following the retirement of Mr. V. C. Varcoe.

R.F.D. APPOINTMENT.—Mr. H. F. Spencer has resigned as chairman of R.F.D. Co., Ltd., but will remain on the board. Mr. A. Noble, the company's vice-chairman, succeeds Mr. Spencer as chairman.

TECHNICAL SALES.—Mr. C. H. Barden has been appointed to the Technical Sales Department of Smiths Aviation Division, Wembley. He joined Smiths in 1954 from Foster Transformers Ltd., and worked at first on a guided weapon control system before transferring to autopilot research at the company's Research and Development organization at Cheltenham.

RETIREMENT. — Newton Brothers (Derby), Ltd., have announced the retirement of their managing director, Mr. F. V. Pipe, after 42 years service with the company. In 1950 he was appointed chairman of the board from which position he retired in 1958. Mr. J. A. Garnett has accepted an invitation to join the board of Newton Brothers.

PLESSEY APPOINTMENT.—Mr. M. Haddon-Grant, LL.B., has been appointed assistant secretary of The Plessey Co., Ltd.

SPERRY APPOINTMENT. — Mr. R. I. T. Falkner has joined the Sperry company as general sales manager of the Brentford Division, with special responsibility for aircraft and marine equipment. He assumes the Divisional responsibilities previously held by Mr. R. E. Leete, who has moved to the central organization. Since 1957 Mr. Falkner has been general sales manager of Plessey's Telecommunications Division.

DOWTY ROTOL BOARD.—As from Apr. 1, the board of Dowty Rotol, Ltd. will be: Sir George Dowty, chairman; Mr. C. J. Luby, joint managing director; Mr. E. J. Nicholl, joint managing director; Mr. A. E. Atkins, works director; Mr. H. S. Butt, O.B.E., experimental works director; Mr. L. G. Fairhurst, technical director; Mr. F. J. A. Mangeot, commercial director; Mr. G. F. M. Rufford, financial director; Mr. L. T. P. Banbury; and Mr. R. F. Hunt.

MR. P. F. WRIGHT.—We regret to record the sudden death on Mar. 28 of Mr. P. F. Wright, joint assistant managing director of B.B. Chemical Co., Ltd. He had been with the company—except for the War years—since 1937.

Personal Flying

SPRINGING OFF.—The Skylark, seen here on floats, is a fully equipped companion model to Cessna's standard Model 175, which is among the Cessna types now being demonstrated in this country by Airwork.

REGULATIONS and conditions governing the Business and Touring Aircraft Competition to be held on May 20-21 from Shoreham have now been issued by the R.Ae.C. Entrants will compete for the Osram, Grosvenor, Kemsley and John Percival Cups and Trophies, and for prize money presented by G.E.C., Marshalls Flying School, W. E. Percival and Vigors Aviation.

On the first day of the competition there will be a distance event from Shoreham, over a 400-st. mile course via Lympne, Sywell and Filton. For this event, all seats in the aircraft must be occupied, and points will be awarded to a formula which takes into account a.m.p.g., block speed and the number of seats. On the following day, the aircraft will participate in a number of tests for short take-off and landing, engine starting, ground manœuvrability and elegance, comfort and equipment.

Pilots and entrants must be British subjects, but there are no restrictions on aircraft other than their categorization by weight into three classes up to 12,500 lb. gross. Entry fee is £10 and the closing date is April 21.

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An Open Day is to be held by the East Anglian Flying Club at Ipswich Airport on Sunday, May 22. There will be a prize for spot time of arrival. After lunch (available in the airport restaurant if ordered in advance) the idea is to have a parachute jumping display by a member. At the recent A.G.M. Mr. Nick Upsdale was elected chairman, and Mrs. Jill Parsons, secretary.

Flying instructors Frank Taylor and Stan Ward reported that the two Club Austers had flown a record total of 785 hours during 1959.

Gliding Notes

by Dr. A. E. Slater

FROM the Mocambo Night Club in Athens comes news of Greek gliding. Alex Aldott, who travels about the World with his wife giving dancing exhibitions at night clubs, spends the intervening daylight hours at the nearest gliding centre, if he can find one.

Approaching Athens by air from Italy, he noticed some beautiful lenticular clouds; so he did not lose much time finding out whether he could soar up to them. Athens, however, had not much to offer, and the only place where anyone had even heard of gliding was the Aero Club.

Here Aldott learned that there is one centre, entirely subsidized by the State, 75 miles north of Athens. It operates only in summer, and possesses an open Primary and a Weihe, both built in Yugoslavia, and a Grunau-like machine. I gather from Aldott's letter that pupils are taken up in a Dakota to be taught how to handle the controls, so the overall cost of gliding works out at the equivalent of £8 an hour—at the State's expense.

But the future looks brighter. The Greek gliding people are hoping to get a pair of two-seaters: a Bocian from Poland and an Ifjusag from Hungary.

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FURTHER news of the R.A.F. Wave Project at Carlisle is that three high climbs were made on Mar. 24, the best being 13,500 ft. in the Olympia 401 by Gp. Capt. N. W. "Paddy" Kearon, who stayed above 10,000 ft. for three hours. Others to exceed 10,000 ft. were the president of the R.A.F. Gliding and Soaring Association, Air Chief Marshal Sir Theodore McEvoy, in an Olympia, and Flt. Lt. Alan Loveland, who was already showing considerable skill in finding elusive waves when I was there a week earlier.

The weather chart shows a S.E. wind blowing from the Lake District. The Helm Wind had still refused to blow; but, at the time of writing, the wind has turned north-east, so they may have got it at last. Crossfell's best hitherto was 11,140 ft. in 1939, but it may yet beat Skiddaw's 13,500 ft., as the first is a long ridge and the second only an isolated lump.

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On arrival, they found that six inches of snow had been cleared from the launching strip and piled high on each side, leaving a clear strip about 60-ft. wide, just enough for the wing span of a Breguet 901. It was Christmas eve, and Willbie was taken up in a Castel 25S to 14,190 ft. in a wave; but in the afternoon a rotor cloud, which had built up to the north, moved over the airfield and created too much turbulence for launching. It was still there next day, and caused the tow-rope to come off at 800 ft. when the *Newsletter* editor was launched in the Castel. On another occasion, when he was going up solo, he mistook the tug's rocking wings for a release signal, but again the turbulence was responsible; and on the same day it caused Willbie, flying a Fauvette, to overtake the tug, causing back-release of the cable.

But in spite of all these troubles, they got some good wave flights. On Dec. 28 the *Newsletter's* editor found 15 ft./sec. lift with a Nord 2000 (similar to Olympia) but had been ordered not to exceed 15,000 ft. as he had no oxygen. The most promising day was their last one, Dec. 31, when both Englishmen were told they could have as many tows as they needed to get their Gold "C" heights, and were given barometric parachutes and two oxygen bottles, one being a small bottle strapped to the leg in case of high-altitude bale-out. Oxygen was necessary to allow sufficient climb from the point of release, since the airfield was 5,000 ft. up to start with. But they found the lift too narrow and weak for success.

On the previous day, other pilots had reached 24,700 and 26,700 ft. The wave-soaring technique, as taught at La Llagonne, is to press forward well into the wave, then drift backwards into the region of strongest lift, then explore sideways, left and right, in the hope of finding still better lift.

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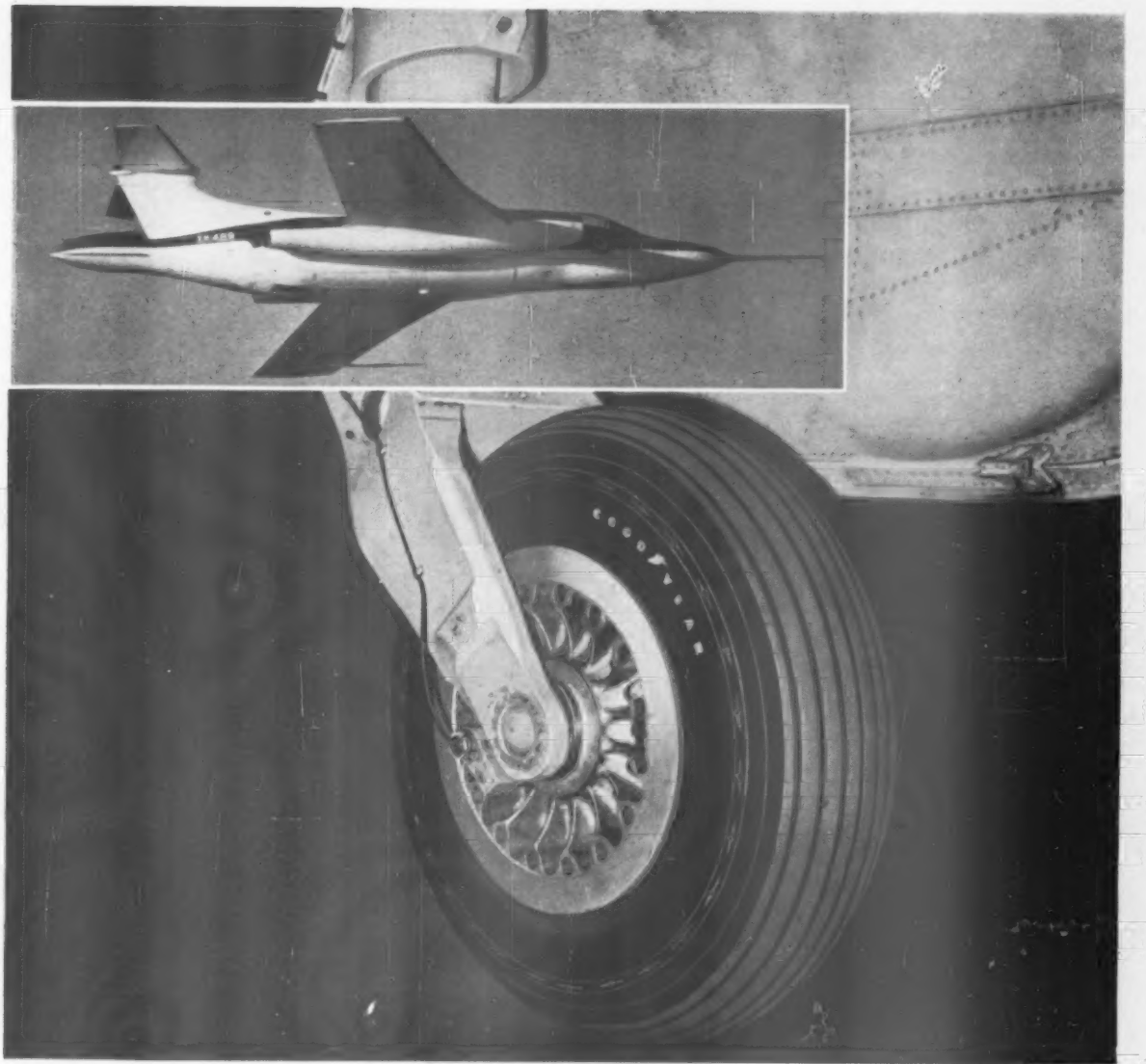

Photographs show Blackburn NA39 low-level strike aircraft, and close-up of wheel assembly. By courtesy of Blackburn Aircraft Limited.

Blackburn NA39's will come in on Goodyear

When they land, production Blackburn NA39 aircraft will be depending on tyres, wheels, brakes and anti-skid equipment by Goodyear—proved equipment that's without peer for efficiency, reliability and economy in weight.

Brakes—maximum non-fading reserve of braking power. Light and strong. Rapid cooling. Easy to maintain.

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GOODYEAR AVIATION DIVISION

SERVING AVIATION THE WORLD OVER

Personal Flying

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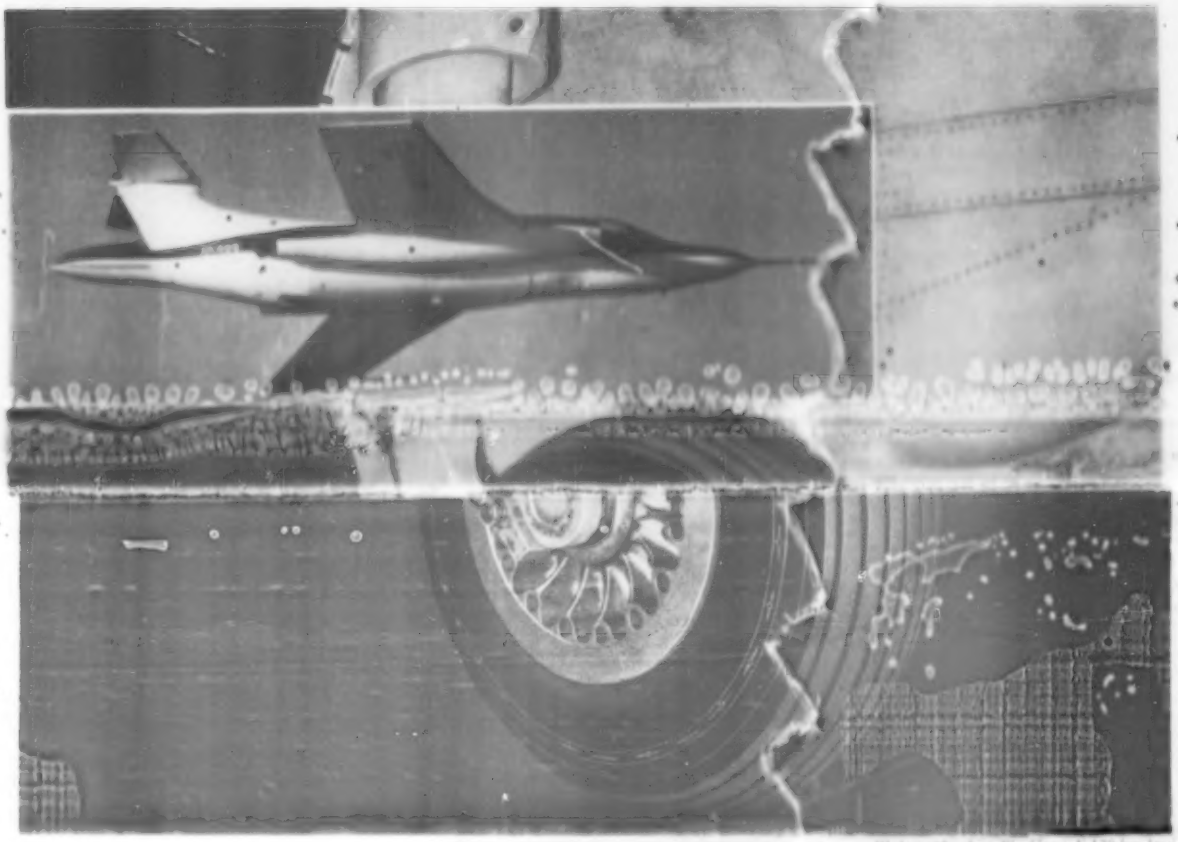

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GOODYEAR AVIATION DIVISION

SERVING AVIATION THE WORLD OVER

Correspondence

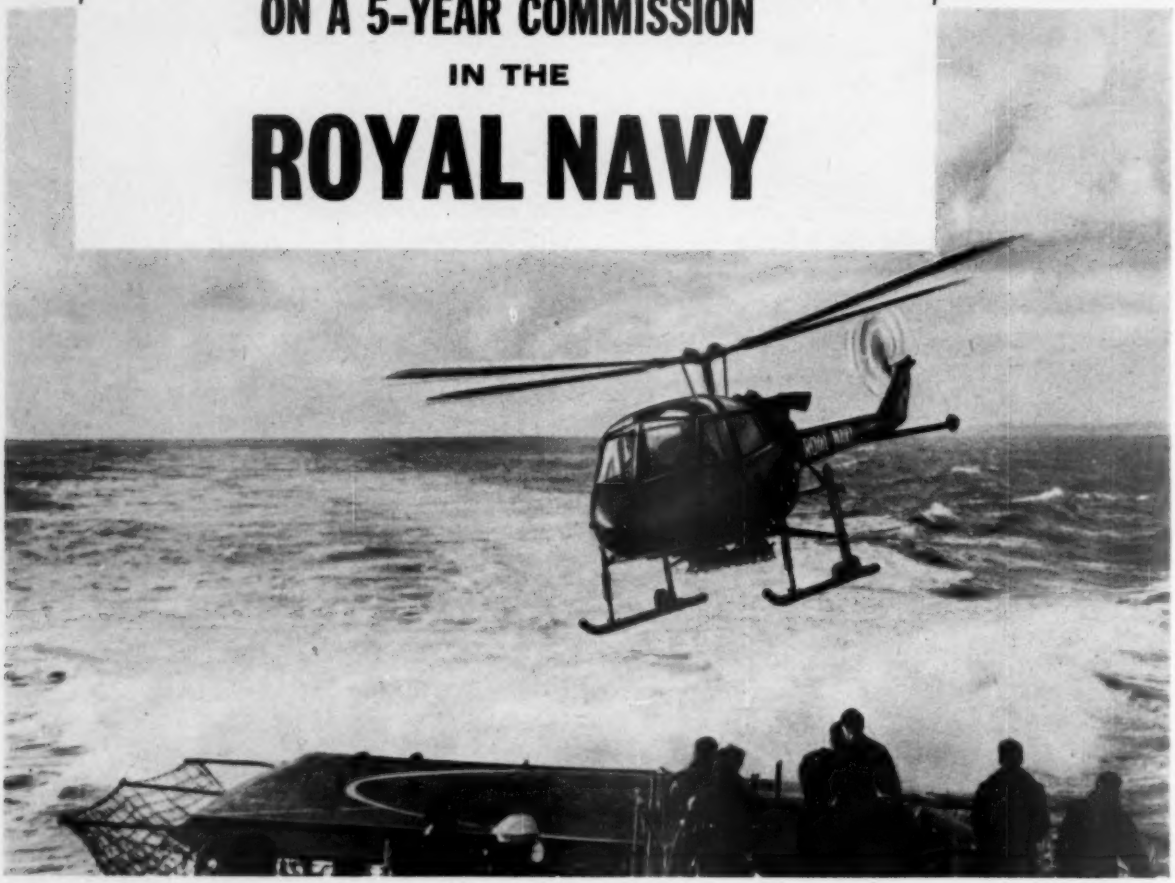
well be "knocking on the door" of the R.A.F. XI before long, e.g., Flt. Lt. K. Briggs (Cranwell), Flt. Lt. R. Gunn (H.Q.F.C.) and Flg. Off. D. Bryett (Halton).

The Adastrians have a strong fixture list and in order that we may uphold the tradition and good name of the Club,

Fly as a Helicopter Pilot

ON A 5-YEAR COMMISSION IN THE

ROYAL NAVY



Britain's New Navy is producing some formidable answers to the problems of anti-submarine warfare. Here is one of them—a light helicopter—operating from a platform only 21 x 26 ft. on a frigate steaming at high speed.

Helicopters are used for a variety of purposes in the Fleet Air Arm: for anti-submarine warfare, for air-sea rescue, for the relief of distress and with Commando Units of the Royal Marines.

Whatever the task may be it requires skill, resourcefulness and nerve to be a helicopter pilot. It is an interesting job of a refreshingly individual kind for those who have the right qualities of character and the necessary educational qualifications. The age limits are 17 to 23 and you must have passed at least four subjects in G.C.E. at "O" level including English Language and Mathematics.

The term of engagement is a five-year Supplementary Commission and at the end of this you will receive a tax-free gratuity of £675. The increasing use of helicopters offers opportunities to trained pilots in civil life afterwards.

Write for full details to: OFFICER ENTRY Dept AP/18 ADMIRALTY
Queen Anne's Mansions, London, S.W.1

Correspondence

American Executive Aircraft

I HAVE just read your article (Mar. 25) "Personal Flying." The matter contained in this covering the type approval of American aircraft and radio is not strictly correct, and I feel sure that you will not be offended if I point out these inaccuracies.

This firm has spent considerable time and money over the past 18 months to bring about the acceptance of the complete Piper range for the British public transport C. of A. As a result of this work, the PA-22 Tri-pacer (both 150 and 160 h.p. models) has now been accepted for the public transport category. Flight Manuals have been prepared for all the remaining Piper aircraft and we believe that the upgrading of all these aircraft in the public category is imminent.

We have also devoted considerable time and effort to obtain type approval for various American radio equipment. However, the radio situation has now been completely clarified by the Ministry of Aviation Equipment Data leaflet No. 6, issued on Mar. 25. There is a wide variety of American radio and navigational aids which qualify for the Class I category. This is particularly so in the Collins range, which is probably the highest class lightweight equipment available in the World, and practically all of which is type approved by M.o.A. in the Hire and Reward category.

Kidlington, Oxford. T. A. VIGORS.
(Vigors Aviation, Ltd.)

[We are most grateful to the managing director of this enterprising organization for providing precise information about the acceptance of American executive aircraft and equipment for British public transport C. of A.—ED.]

Piston-engine Data

MAY I suggest that it would complete the useful information given in your International Power Plant Data if you were to add a column for piston engines showing the minimum knock ratings and maximum permissible lead content for the fuel as recommended by the manufacturers.

Nairobi. M. A. COLVIN.

No. 60 Squadron History

IT would be appreciated if you could make known that the history of the above Squadron is inadequately recorded.

Personal accounts from past members of the Squadron, together with any other contributions, either written or photographic, would be greatly appreciated to rectify this situation. Of particular interest is any lead which may help to locate the Squadron's silver collection amassed in India between the Wars and lost as a result of the Japanese invasion of Malaya.

Any communications should be addressed to the undersigned, who will return any documents and photographs loaned for copying.

R.A.F., Tengah, Singapore 24. D. W. WARNE.
(Flt. Lt., for Officer Commanding
No. 60 (N.A.W.F.) Squadron.)

Adastrian Cricket Club

AS the newly elected match Secretary of the Adastrian C.C., I was delighted to see Air Cdre. Spaight's letter on the subject of "More R.A.F. Cricket" (Mar. 11).

The support of all officers, but in particular senior officers, is of vital importance to the Adastrian C.C. and the R.A.F. Cricket Association if we are to field the best side against our traditional "enemies"—the Army and the Navy. The end of National Service is in sight and we shall once more depend upon the regular Service officers and airmen for a representative side. Apart from the competition within the R.A.F., the Adastrian C.C. will be the best way in which officers and, in special circumstances, airmen can qualify themselves for the Air Force XI.

The first match of the coming season will see the introduction of a new fixture designed to implement this policy. On Apr. 30 and May 1 the R.A.F. XI will play the Adastrians at Vine Lane, Uxbridge. The R.A.F. XI which contains many Adastrians, will be captained by Sqn. Ldr. E. Senior. They will be given a hard fight by a strong Adastrian XI captained by Wg. Cdr. R. G. Wilson, himself an ex-R.A.F. cricketer. He will be supported by other well-known R.A.F. cricketers, e.g., Sqn. Ldr. M. D. Fenner (another ex-R.A.F. skipper), Sqn. Ldr. R. Kinsford (captain of Sussex II), Padre W. E. G. Payton and Sqn. Ldr. M. J. Swiney.

There will be a number of young officers playing who may well be "knocking on the door" of the R.A.F. XI before long, e.g., Flt. Lt. K. Briggs (Cranwell), Flt. Lt. R. Gunn (H.Q.F.C.) and Flg. Off. D. Bryett (Halton).

The Adastrians have a strong fixture list and in order that we may uphold the tradition and good name of the Club, and the R.A.F., against such sides as the Free Foresters, Cross Arrows at Lords, Kings College School (Wimbledon), Ampleforth College, Stoics, Incogniti, Buccaneers, etc., we shall need all the encouragement and support that everyone can give us.

Taplow, Bucks. H. W. HOWE.

Groundabout

Success! Sqn. Ldr. Brian Mercer, ex-Treble-One team pilot, has already chalked up one commendable achievement in his new job as a Schools Liaison Officer. On hearing what R.A.F. pay and conditions were, one school's Careers Master promptly joined up. For some reason, I'm reminded of the potent potentate from the Middle East who, at the S.B.A.C. Display, examined, sat in, and was flown in, a variety of aircraft, then bought the President's tent.

*

Something of Importance. During the visit of a group of high-powered atomic scientists to a Government establishment in London, a long-distance call arrived for one of them. After several internal calls had been made, the party was located and a senior staff member took the visitor discreetly aside and told him there was an urgent long-distance call for him. They hurried to a private room where the door was closed behind him. He picked up the phone—"Hallo, yes?" A delighted childish voice replied—"Daddy! Will you be home late tonight?"

*

"It was obsolescent when it came off the drawing board—fortunately, it was a damn good drawing board."

*

Grilled. I thought the Viscount was entering a new lease of life when a friend at Weybridge rang me and quoted from a brochure: "THE NEW 3-PLATE VISCOUNT — EYE-LEVEL CONTROLS — GLASS DOOR—FULL SIMMER CONTROL. . . ." "Three-plate," I thought, was some sort of built-in IATA-limited meal; "glass door," maybe an aid to reassuring the steward that somebody really *is* coming with those passenger steps. But "simmer control"? Of course, you bright types knew it was an electric oven all along.

*

Wreminiscing. A friend at Bristol's suggests that their 188 represents the ultimate "Oddentification" and that I might do a caricature and wrhyme, in the old War-time style, of that aircraft. Well, here's the 188 going through the heat barrier, plus a little jingle which outlines the sequence of this branch of the art (?) of distortion:

*

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Meditate—
Initiate—
Fabricate—
Accentuate—
Simplicate—
Animate—
Oddentificate—
Terminate—
One-Eight-Eight!

by Grosvenor

Industry Record

Marconi in India

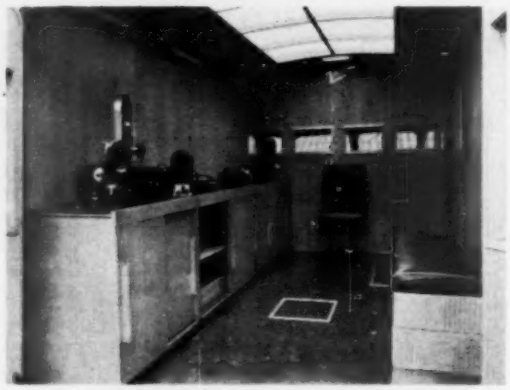
An agreement has been signed in New Delhi between the Indian Government and Marconi's Wireless Telegraph Co., Ltd., for co-operation in the local manufacture under licence of equipment of Marconi design. The agreement, which provides also for technical assistance and the supply of materials and components, will form the basis for Indian manufacture of equipment in the aeronautical radio, sound and television broadcasting, communications and radar fields.

The range of aeronautical radio equipment has particular application to the Avro 748 transport which is being produced at Kanpur.

Photographic Equipment on Tour

Cinematograph Export, Ltd., an associate company of W. Vinten, Ltd., is at present undertaking a European sales and demonstration tour. Lasting until the middle of June, it includes visits to government departments and aircraft manufacturers in France, Italy, Austria, Switzerland and Germany.

For the tour the company is using a demonstration van and trailer which are carrying a comprehensive selection of the latest products, so that examples of various types of equipment can be shown. These include a range of airborne units such as a 70-mm. reconnaissance camera (known in the R.A.F. as the F.95); the G.90 16-mm. combat recording camera; and a number of air or ground 16-mm. research cameras which cover operating speeds of up to 250 pictures per second. Vinten ground equipment in current production includes a 70-mm. take-off camera and the H.S.300, a 35-mm. high-speed camera.



The interior of the Vinten demonstration van with some of the company's airborne cameras on display.

Details of the tour itinerary can be obtained from Cinematograph Export, Ltd., at 715 North Circular Road, London, N.W.2.

Chrome Processing Plant

Holman Brothers, Ltd., of Camborne, has enlarged and re-equipped its Durion hard-chrome deposition plant to meet demands from within the Holman Group and from other companies. This development, which follows the opening of the new Holman heat treatment department, is said to place the Group in an advanced position in the field of metal treatment and finishing.

Climax Durion hard chrome is chiefly used to provide a wearing surface of great hardness and durability for all types of metal with the exception of aluminium. It possesses an extremely low coefficient of friction, has high corrosion and abrasion resistance, and can be used to salvage components that are undersized, chipped or have damaged edges, by rebuilding and restoring to original specifications.

The Durion process is also used as an alternative to surface hardening by heat treatment and has an additional advantage in that parts can be re-treated when the chrome has worn away. It prevents pick-up and seizure between stainless steel and non-ferrous components and can take a highly polished mirror finish.

Transistor Speech Amplifier

A speech amplifying system for use in aircraft has been designed by W.S. Electronics, Ltd., of East Acton. It is intended for providing information and commentary to passengers. The amplifier is completely transistorized and operates from 28 V. D.C.; it requires no warming-up period and weighs 5 lb. It has an output of 10 watts and the only controls are volume and on/off switches.

Aviation Calendar

Apr. 8

London.—R.Ae.S. Rotorcraft Section lecture, "Experiences with an Operational Heliport," by R. A. C. Brie, in the Library, 4 Hamilton Place, W.1, at 18.00 hrs.

Apr. 13

Brough.—R.Ae.S. Brough Branch Annual General Meeting.

Weybridge.—R.Ae.S. Weybridge Branch lecture, "Structural Aluminium Alloys for High Speed Flight," by Dr. W. M. Doyle, at the Apprentice Training School, Vickers-Armstrongs Aircraft, Ltd., at 18.10 hrs.

Chester.—R.Ae.S. Chester Branch lecture, "Ramjets," by M. A. Needham, in the Lecture Theatre, Grosvenor Museum, at 19.30 hrs.

London.—The British Institution of Radio Engineers Computer Group lecture, "Guided Weapon Control," at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, at 18.30 hrs.

Apr. 14

Belfast.—R.Ae.S. Belfast Branch Annual General Meeting in the Lecture Hall, LG.8, David Ken Building, Queen's University, at 19.00 hrs.

Glasgow.—R.Ae.S. Branch Graduates' and Students' Section A.G.M. and Debate, in the Engineering Building, University of Glasgow, at 19.30 hrs.

Apr. 15

Merthyr Tydfil.—R.Ae.S. Branch lecture, "Instrumentation from the Pilot's Point of View," by Capt. T. Farnworth.

Apr. 20

Reading.—R.Ae.S. Branch lecture, "The Radio Telescope," by Dr. H. P. Palmer, in the Top Canteen, Western Manufacturing, Ltd., at 18.00 hrs.

Company Notices

NEW COMPANIES

Tawney Aircraft, Ltd. (651,259).—Private co. Reg. Mar. 3. Cap. £1,000 in £1 shs. Objects: To carry on the business of manufacturers of and dealers in aeroplanes, etc. Directors: Eric F. Thurston, 46 Theydon Park Road, Theydon Bois; Anthony M. Creedon, 50 Ram Gorse, Harlow. Sec.: N. E. A. Wilkes. Reg. off.: Stapleford Aerodrome, Stapleford Tawney.

Grimsby Aviation Co., Ltd. (651,310).—Private co. Reg. Mar. 3. Cap. £1,000 in £1 shs. Objects: To acquire Old Waltham R.A.F. Aerodrome, Lincs, and to establish the Grimsby Flying Club. Directors: James R. Walgate, Cuxwold Hall, Cuxwold, Caistor; John E. T. Bacon, Keddington Grange, Louth. Reg. off.: Control Tower, Grimsby Aerodrome, Waltham, Lincs.

South Wales and Mon. Freight Clearance Co., Ltd. (651,369).—Private co. Reg. Mar. 3. Cap. £1,000 in £1 shs. Objects: To carry on the business of general agents and carriers of passengers, livestock and goods by land, water and air. Directors: Roy E. Arnesen and Lilian M. Arnesen. Reg. off.: 11 Commercial Street, Cwmbran, Mon.

Farm Aviation, Ltd. (651,681).—Private co. Reg. Mar. 7. Cap. £4,000 in £1 shs. Objects: To carry on the business of agricultural and aero contractors. Directors: Geoffrey C. Beckwith, The Cottage, Whiteway Bottom, near Luton; William S. Bowker, 76 High Street, Whitewell; Michael A. Pruden. Sec.: M. A. Pruden. Sols.: Hartley and Hinc, Hitchin. Reg. off.: Wellbury Farm, near Hitchin.

Artisan Engineering Co., Ltd. (651,829).—Private co. Reg. Mar. 8. Cap. £400 in 10s. shs. Objects: To carry on the business of precision, electrical, mechanical and general engineers and contractors, retail dealers in aircraft and industrial machined components. Directors: George H. Shaw, 29 Pulley's Lane, Hemel Hempstead; Edwin V. Blackaby, 51 Hawthorn Lane, Hemel Hempstead; Clifford A. Steele and Ralph E. Winzer. Reg. off.: 63 Ellingham Road, Hemel Hempstead, Herts

New Patents

APPLICATIONS ACCEPTED

834,409.—**Koninklijke Luchtvaart Maatschappij N. V., Derksen, J. W., and Kips, E. J. E.**—"Apparatus for aircraft for use in blind landings or blind take-offs."—Feb. 28, 1956 (Mar. 7, 1955).

834,480.—**National Research Development Corporation.**—"Aircraft and aircraft simulator instrument presentations."—Jun. 12, 1958 (Jun. 12, 1957).

834,587.—**Bolkow, L.**—"Rotary wing aircraft."—Nov. 29, 1956 (Dec. 7, 1955).

834,661.—**Link Aviation, Inc.**—"Ground flight trainers."—Apr. 5, 1956 (Apr. 14, 1955).

834,662.—**Link Aviation, Inc.**—"Simulated vehicles having movable supports."—May 19, 1956 (May 10, 1955).

834,731.—**Soc. Nationale D'Etude et de Construction de Moteurs D'Aviation.**—"Aircraft."—Jan. 30, 1958 (Feb. 6, 1957).

834,532.—**Garden, A. D.**—"Wings and other main support aerofoils in aircraft."—Jan. 31, 1957.

834,550.—**Rolls-Royce, Ltd.**—"Fuel control system for a jet reaction engine provided with a thrust reversing mechanism."—Dec. 13, 1956 (Dec. 21, 1955).

834,800.—**Minister of Supply.**—"Turbine-driven fans."—Mar. 28, 1956 (Apr. 6, 1955).

834,846.—**Rolls-Royce, Ltd.**—"Aircraft."—Jun. 17, 1958 (Jun. 25, 1957).

834,678.—**Short Bros. and Harland.**—"Landing or alighting gear for aircraft."—Feb. 18, 1958 (Feb. 20, 1957).

834,907.—**Rolls-Royce, Ltd.**—"Jet propulsion nozzles."—Oct. 15, 1957 (Oct. 23, 1956).

Printed specifications of the above will be available on May 11, 1960 and the opposition period will expire August 11, 1960.

835,221.—**Minister of Supply.**—"Aircraft."—Aug. 15, 1956 (May 26, 1955).

835,134.—**Boeing Airplane Co.**—"Noise suppression nozzle with thrust reversal provision for jet propulsion engines."—Jan. 23, 1957 (Feb. 7, 1956).

Printed specifications of the above will be available on May 18, 1960, and the opposition period will expire on July 18, 1960.

Personal Notices

BIRTHS

Norris.—On Mar. 23, at R.A.F. Hospital, Wegberg, to Juliet (*née* Stanley), wife of Sqn. Ldr. Philip Norris, M.B., Ch.B.—a daughter.

Opie.—On Mar. 18, at Northlands Maternity Home, Emsworth, to Penny (*née* Hoare), wife of Flt. Lt. B. W. Opie—a daughter.

Osterberg.—On Mar. 27, at Glenroyd Maternity Hospital, Blackpool, to June, wife of Flt. Lt. R. D. Osterberg—a son.

MARRIAGES

Boyce—Meenagh.—On Mar. 19, at Tong, Shropshire, Flt. Lt. T. S. B. Boyce to Elizabeth Meenagh.

Quayle—Yealland.—On Mar. 19, at St. Michaels and All Angels, Southampton, Wg. Cdr. A. A. Quayle, R.A.F. (Retd.), to Mrs. D. A. Yealland.

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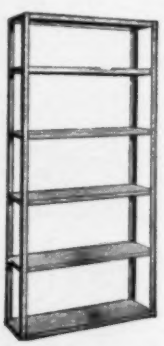

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AIR TRANSPORT ADVISORY COUNCIL.

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM AIRWORK, LTD., OF 35 PICCADILLY, LONDON, W.1:—

APPLICATION NO. 3347 (amended) for a Normal Scheduled Service with Viscount and Britannia aircraft for the carriage of passengers, supplementary freight and mail on the route London (Gatwick) or London Airport-Lisbon (opt.)-Porto Santo (without traffic rights between London and Lisbon) at a frequency of four return flights weekly for 10 years from the opening date of Porto Santo Airport; and for the inclusion of an optional traffic stop at Porto Santo on their Normal Scheduled Service on the route London - Lisbon - Las Palmas - Dakar - Bathurst-Freetown-Takoradi (opt.)-Accra (Application No. 1462).

FROM HUNTING-CLAN AIR TRANSPORT, LTD., OF LONDON AIRPORT, HOUNSLOW, MIDDX.:—

APPLICATION NO. 3348 (amended) for a Normal Scheduled Service with Viscount, DC-6C and Britannia aircraft, for the carriage of passengers, supplementary freight and mail, on the route London-Lisbon (opt.)-Porto Santo (without traffic rights between London and Lisbon), at an initial frequency of four return flights weekly increasing later in accordance with traffic demand, for 10 years from the opening date of Porto Santo Airport; and for the inclusion of an optional traffic stop at Porto Santo on their Normal Scheduled Service on the route London - Lisbon - Las Palmas - Dakar - Bathurst-Freetown-Takoradi (opt.)-Accra (Application No. 1456).

FROM EAGLE AIRWAYS, LTD., OF 40 EDGWARE ROAD, LONDON, W.2:—

APPLICATION NO. 3452 for a Normal Scheduled Service with Viscount and DC-6C aircraft for the carriage of passengers, supplementary freight and mail, on the route London Airport-Pisa (opt. tech.)-Rome (opt. tech.)-Rhodes at an initial frequency of two return flights weekly increasing later in accordance with traffic demand, for 10 years from 1961.

FROM B.K.S. AIR TRANSPORT, LTD., OF BERK HOUSE, BAKER STREET, LONDON, W.1:—

APPLICATION NO. 3453 for a Normal Scheduled Service initially with Dakota and Ambassador aircraft and later also with Avro 748 aircraft, for the carriage of passengers, supplementary freight and mail, between Leeds and Bradford Airport and Amsterdam, at a frequency in accordance with traffic demand, for seven years from date of approval.

These applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. 529-1

DISPOSAL OF FLYING LOG BOOKS.

A Number of Flying Log Books, which are normally returned to Aircrew on leaving the Services, are held by the Admiralty, War Office and Air Ministry because they have not been claimed.

EX-SERVICE personnel concerned (or, if deceased, their legal next-of-kin) who wish to claim these books should apply before September 15, 1960, giving full service particulars, to:—

(I) Ex-Royal Navy: Flag Officer Air (Home), Wykeham Hall, Lee-on-Solent, Hants.

(II) Ex-Army: The Officer-in-Charge, Infantry Records, Higher Barracks, Exeter.

(III) Ex-Royal Air Force: (a) Officers, The Under Secretary of State, Air Ministry (A.R.8), Adastral House, Theobalds Rd., London, W.C.1. (b) Airmen, The Air Officer Commanding, R.A.F. Record Office, Eastern Avenue, Barnwood, Gloucester.

BOOKS not claimed before September 15, 1960, will be destroyed. Some books will unavoidably have been lost or destroyed through enemy action and intending applicants should note that it will not be possible to satisfy all claims. 529-13

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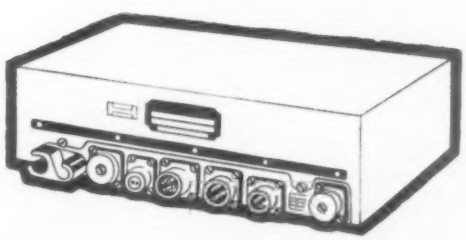

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Plying through jungle and junks

The river Mekong is the only practical route through the dense undergrowth of Viet-Nam and up-country to the interior of Cambodia. Shell uses the river to supply the airport at Pochentong. But, unfortunately, everybody else uses the river as well. Sampans, houseboats, lighters, barges and the never ending array of junks. Hundreds upon hundreds of them.

The 940-ton Shell tanker 'Angkor' regularly threads her way through this floating jungle on the 300-mile voyage. During the day it's not so bad. At least you can see the boats or, if they are hidden around the next bend, you are bound to hear the hub-bub and commotion long before you reach them. But at night all is quiet and there's hardly a light to warn the skipper of the haphazardly moored craft. Nor a warning of the fishing stakes and nets that go with them. Navigation needs the utmost skill and experience, also a good deal of patience.

Man-made hazards are not all the skipper must contend with. The surrounding countryside is flat and marshy and the river changes its course with the seasons. A channel today may be sand and coral on the next voyage, or just a collection of small streams zig-zagging through the swamp.

But whatever the obstacles, Shell always gets the vital supplies through. Pochentong airport knows that. So do hundreds of similar airports all over the world. Wherever aviation products are needed, be it via desert, swamp or forest, Shell will find a way to get them there regularly.

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